IMPACTS OF POPULATION AGEING ON CHINA'S ECONOMY: LABOR FORCE, SAVINGS AND CONSUMPTION

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DEDICATION

This dissertation is dedicated to my parents, Zhang Zhaolun and Meng Xian'e, and my elder sister, Zhang Xia, who always encourage, support and help me during my PhD study.

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LIST OF ABBREVIATIONS

Dandu Couple: Couple in which wife or husband is only child

FE: Fixed Effect model

GDP: Gross Domestic Product

GMM: Generalized Method of Moments estimation

HLM: Hierarchical Linear Model

Hukou: Household Registration System in China

ISSS: The Institute of Social Sciences Survey at Peking University in China

NBS: National Bureau of Statistics of the People's Republic of China

NDRC: National Development and Reform Commission of the People's Republic of China

NPFPC: National Population and Family Planning Commission of the People's Republic of China

OLS: Ordinary Least Square model

PRC: The People's Republic of China

RE: Random Effect model

Shuangdu Couple: Couple in which both wife and husband are only child

SRB: Sex Ratio at Birth

TFR: Total Fertility Rate

UN: United Nations

UNFPA: United Nations Population Fund

USA: United States of America

ABSTRACT

China has been experiencing profound changes in its population due to the three-decade implementation of the one-child policy, including imbalance in sex ratios, low fertility rates, and population ageing. This thesis focuses on the growing significance of population ageing in China and the impacts of ageing on labour force supply, savings and consumptions in the economy.

China would witness an accelerating ageing process in the next three decades, even though the government has implemented the new fertility policy in 2016. Using the simulation model based on the data from the Chinese 2010 census, this thesis first examines the changes of fertility rates under sudden policy adjustment – the abolition of its decades-long one-child policy and the implementation of a two-child policy. The results show that the two-child policy makes a significant but temporary effect on fertility rates and annual births in China, which marginally affects the demographic future in the country. The labour force supply in the future would be confronted with a declining in the size and proportion, an ageing process, and increasingly growing costs, which further weaken the competitiveness of the economy in international trades. The thesis also investigates the impacts of ageing on the declining in labour force participation rates using the standardization method, indicating a contribution of 24% to the overall decline in labour force participation rates during 2000-2010.

Based on both macro-level data from provincial statistics and micro-level data from the China Family Panel Studies 2011, the study also explores the effects of ageing on savings and consumption. The findings suggest that ageing affects household economic behaviours through two mechanisms, one of which negatively affects savings and consumption through an ageing population structure, and the other of which positively increases savings and consumption by

supporting elderly parents in the family. These findings deepen the understanding of the relationship between population ageing and the economy, and extend the application of related theories in the case of China. The thesis provides evidence-based analysis that will contribute to the evaluation and formulation of further economic reforms under a rapidly ageing demographic condition in the country.

Key words: Population ageing; one-child policy; two-child policy; labour force supply; household savings; household consumption; China

CERTIFICATION

I, Xianling Zhang, declare that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy, in the Department of Management and Marketing of the Faculty of Business and Economics at Macquarie University, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Xianling Zhang

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Chapter 1 Introduction

1.1 Background

Over the past several decades, the Chinese population has been experiencing profound changes both in size and structure (Yang, 2012). In the early days of the regime of the People's Republic of China (PRC), the population in the country was about 542 million in 1949, which afterwards rapidly increased and doubled to 1.08 billion in 1986 (NBS, 2015). Specifically, the Chinese population has retained the first place in the world throughout much of the recent history. As the most populous country, China's population size was estimated at 1.38 billion at the end of 2016, accounting for about 18.4% of the world's population (NBS, 2017; UN, 2017). During the same period, remarkable changes in Chinese population age structure have taken place as well. According to the first population census in China, the Chinese population presented a triangle shaper, with the proportion of children aged 0-14 at 36.38% and the share of the elderly population aged 65 and above at 4.41% in 1953 (NBS, 1985). However, as stated in the most recent population census communique, the Chinese population in 2010 become much older, which was revealed by an increasing share of the elderly (8.9%) and a decreasing proportion of children (16.6%) (NBS, 2012). The Chinese population are undergoing remarkable changes both in size and age structure.

During the past half century, the Chinese population completed its demographic transition process, whereby a pre-modern regime of high fertility and high mortality was replaced by a post-modern one in which both birth and death rates are low. It is argued that China completed the demographic transition process within three decades, which is much shorter than that in western countries (Li, 2000). As what happened in demographic transition of other countries, China began its demographic transition process with an earlier decline in mortality rates. From

the 1950s to 1980s, the life expectancy at birth in China experienced a substantial and steady increase, from between 35 and 40 years to 65.5 years (Yao and Yin, 1994), which was argued to be the result of the expansion of public health care services, implementation of widespread public health campaigns, particularly childhood immunization programmes, enhancement in water and food quality and improvement in educational attainments (Sidel, 1972; Banister and Preston, 1981; Coale, 1984; Banister, 1987; Campbell, 1997, 2001; Dong and Phillips, 2008; Babiarz et al., 2015). Following the decline in mortality rates, the fertility transition later took place in the country (Figure 1.1). Initially the fertility decline started in large cities and urban regions among educated women, which happened prior to the family planning program implementation. Urban fertility began to fall in the 1960s, arising from achievement in education attainments, improvement in women's labour force participation, reduction in infant mortality rate, and adoption of contraceptives among urban women (Lin, 1987; Peng, 1989; Peng and Huang, 1993; Li, 2003). During this period, the fertility decline in the better educated strata in China urban areas was under way well before the introduction of major government birth control programs, which instead was closely associated with education and urbanization (Lavely & Freedman). However, the overall fertility rate in the country was still relatively high at that time in spite of the fertility decline in large cities and urban areas, due to high fertility rate in rural regions. The total fertility rate in China was 5.81 in 1970, which indicated that each Chinese women averagely gave birth to 5.8 children over their life time (Yu, 2009). Due to this high fertility rate and declining mortality rate, the Chinese population grew rapidly in this period (NBS, 2005; Zhai et al., 2011), which was regarded as the second stage of demographic transition. Driven by the rapid population growth and ensuing challenges to the society and economy, the Chinese government initially introduced birth control campaigns in the 1960s and

implemented the effective birth control policy in the early 1970s, gradually spreading from urban to rural areas. Eventually, the Chinese central government put the ambitious and controversial one-child policy in place in the 1970s (Gu, et al., 2007; Zhai and Yang, 2011). The government intervention with implementing the family planning program and birth control policy significantly reduced women's fertility rates in China. The total fertility rate in China fell to the replacement level in the early 1990s. In addition, socioeconomic developments were also important facilitators of fertility change, as evidenced by the consistent relationships between education, work involvement, economic growth and fertility in the course of transition (Whyte and Parish, 1984; Banister, 1987; Gu, 1987; Cai, 2010). At the turning of the twenty-first century, the crude birth rate and death rate were both low in China, which were 14‰ and 6.45‰ in 2000 respectively (NBS, 2001), indicating that the Chinese population stepped into the third stage of demographic transition. Furthermore, as stated in the newest statistical report published by the National Bureau of Statistics, the crude birth rate was 12.95‰ and the crude death rate is 7.09‰ in 2016 (NBS, 2017). More specifically, China completed its profound demographic transition process before the 2000s (Li, 2000), whereby a pre-modern regime of high fertility and high mortality was replaced by a post-modern one in which both birth and death rates are low. When compared with the Western countries that underwent their respective demographic transition processes over hundreds of years, China experienced a much more rapid demographic transition process in about three decades (Livi-Bacci, 2012), which resulted in remarkable changes in its population age structure.

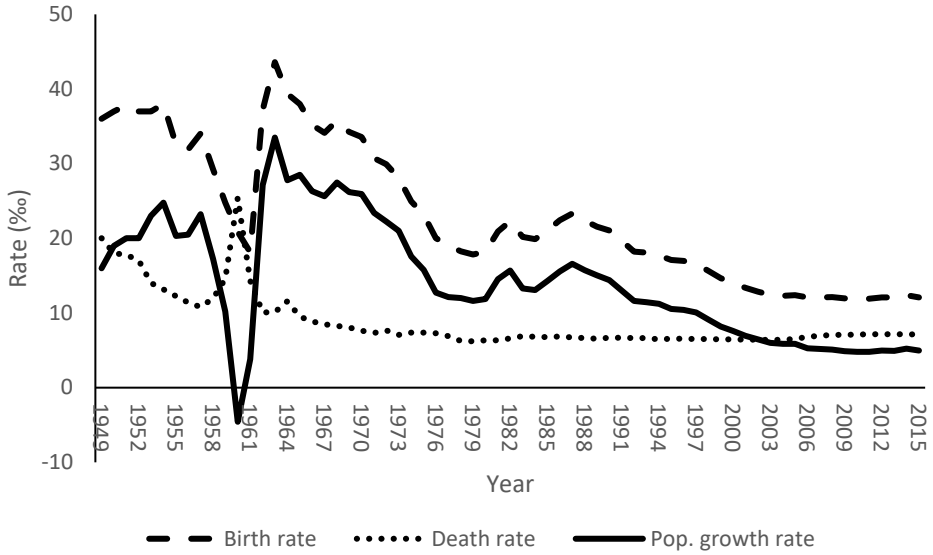

Figure 1. 1 Birth rate, death rate and population growth rate in China, 1949-2015

Sources: National Bureau of Statistics of the People's Republic of China. 2016. China Statistical Yearbook 2015. Beijing: China Statistics Press.

In addition to profound changes in its population, China's economy attains impressive and remarkable achievements during the past four decades. The Chinese government makes much effort to boost its socioeconomic development, including implementing political and economic reforms, as evident in the initiation of the Reforms and Opening Up in 1978. Over almost four decades, Chinese economy has made great economic advances, resulting in the fastest economic growth (which averaged at nearly 10% annually), attracting worldwide attention (Lin, Cai and Li, 1999; Cai, 2006). In 2010, the Chinese economy replaced Japan in the second place in the world based on the size of economy, with the United States occupying the first place (World Bank, 2011). The economic miracle in China greatly improved the living standards of its citizens. As China is the most populous country, this is equivalent to one-fifth of the world population, and those changes have had profound implications for the world's economy as well. This effect was augmented by the country's increasing integration into the world's economy

(Guo, 2008). The great success in the Chinese economy is typically attributed to its demographic dividend with the abundance of cheap labour force and the decline in dependency ratio, the economic and political reforms with institutional supports for economic growth, and large amounts of investments (Bloom and William, 1998; Cai and Wang, 1999; Wang, Cai and Zhang, 2004; Lai, Zhang, Peng and Bao, 2005; Wang and Mason, 2006; Cai, 2010). Among these contributors, the demographic factor is particularly relevant, as it plays an important and influential role in the economic growth in the country. Since the 1980s, both the size and the share of the working-age population (those aged 15−64) in China have been experiencing significant increases, from 625 million in 1982 to 1,006 million in 2013 in size, and from 61.5% in 1982 to 74.0% in 2013, respectively, providing the Chinese economy with abundant labour force inputs (NBS, 2015). At the same time, the total dependency ratio underwent a continuous decline during the past three decades, decreasing from 0.63 in 1982 to 0.22 in 2011, mainly due to the significant decline in the child dependency ratio (NBS, 2015). These demographic changes provide an advantageous population base for the Chinese economy, with a decreasing dependency burden for both the government and the households. Previous studies focusing on population age structure and the economic growth in China show that the decline in the total dependency ratio contributed to about 25% of the contemporary GDP growth during the 1982−2000 period (Wang et al., 2004). It is also estimated that 1% decline in the total dependency ratio corresponded to a contemporary GDP increase of 0.115%. Moreover, the abundance of cheap labour force and the reallocation of labour force at the inter-provincial level also exerted significant positive effects on the Chinese economy during the same period (Cai and Wang, 1999; Li and Li, 2005; Liu and Tian, 2005; Cai, 2010; Jia and Xin, 2010; Hao, 2016). The development strategy of dependence on labour-intensive industries and exports of low-cost

products, on which the Chinese economy has traditionally been based, is the product of the demographic changes in the country. As a result, the Chinese economy attracts large amounts of foreign capital and its abundant and cheap labour force presents powerful competitiveness in international trade, which has won China the title of the world's factory.

The significant and positive effect of demographic factors with large proportion of working-age population on the economy is defined as the first demographic dividend (Bloom and William, 1998; Mason, 2001). As discussed above, the Chinese population underwent remarkable changes both in size and structure during the past four decades (NBS, 2016), resulting in an advantageous population base for the economy in the country. Since the foundation of the regime in 1949, the Chinese population has experienced rapid growth, which is argued to be closely associated with economic growth (Solow, 1956; Coale and Hoover, 1958; Easterlin, 1967; Kuznets, 1967; Simon, 1975; Roomer, 2002; Zuo, 2010). Most scholars consider that population growth negatively affects the economic growth or economic products per capita (Hu, 1993; Qin, 2001; Jia and Meng, 2002; Hu et al., 2012). Zhang (1992) specifically analysed the relationship between population growth and economic growth in China in different stages, he pointed out that the negative impacts of population growth on national income per capita depended on the increasing marginal population growth before 1978, which then depended on growing consumption per capita after 1978. After 1990s, researches on the topics of human capital, institutional innovation and technical improvements showed that these factors played a much more crucial role in economic growth, comparing to population growth (He et al., 2006). In addition to population growth, population age structure also significantly affects economic growth. The contribution of changes in population age structure to economic growth in China is up to 1/4 during the period of 1980 to 2000 (Cai and Wang, 2005). Studies in the

related field show that the abundance of labour force supply, demographic dividend and labour force transfer from agriculture to non-agriculture are the crucial factors contributing to the success of economic growth in China (Bloom and William, 1998; Bloom et al., 1999).

However, China recently started to experience significantly different changes in its population structure. Owing to the sharp decline in fertility rates from those recorded in the 1970s, the TFR in China has been lower than the replacement level for more than twenty years (Yu, 2009; Li and Li, 2012; Yang and Zhao, 2013; Jin, 2014). These changes have had profound demographic consequences, including the long-term imbalance of sex ratio at birth (SRB), the rapid population ageing, growing number of families bereft of the only child and the decreasing labour force supply. Moreover, the social welfare system in China is inadequately developed for supporting its ageing population. All these changes indicate that the country is facing a quite different demographic environment, which is expected to have unprecedented and profound implications for its economy and society. Consequently, the Chinese government is confronted with the urgent task of transforming its development strategy and reducing the dependence on labour-intensive industries and exports of low-cost products.

These phenomena have prompted heated debates among the academics and the policy makers, focusing on the relationship between population and the economy. While the relationship between population and economy has always been a topic of interest, authors of earlier studies tended to focus on the correlation between population size or population growth rate and economic growth, neglecting the link between the population structure and economic growth (Blanchet, 1991). Owing to the rapid economic growth in East Asia during the second half of the 20th century, referred to as the East Asian Miracle, scholars started to focus on the impacts of population age structure on economic growth, defined as the demographic dividend.

Extant studies on this topic show that the population growth and labour force contribute about 20% to the contemporary economic growth, with nuanced differences among countries and regions, whereby 26% is quoted for China, 9% for Japan, 29% for South Korea, and 40% for South Asian region (Bloom, 1998; Bloom and Finlay, 2009). Studies focusing on China's experiences also support the viewpoint that the first demographic dividend exerts significant positive effects on the economic growth (Cai and Wang, 1999; Wang et al., 2004; Wang and Mason, 2005; Che and Guo, 2009). Cai and Wang (1999) pointed out that the population age structure contributes about 20% to the economic growth in China, while also identifying the key factors influencing economic growth. However, other scholars, including Wang and Mason (2005) and Wu (1999), posit that the effect of the first demographic dividend on the Chinese economy is much lower. Despite the evident lack of consensus regarding the extent to which the demographic factors affect the economic growth in China, most researchers concur that the first demographic dividend provides a powerful impetus to the economy.

Along with the demographic changes in China, the sustainability of the country's economy in the future is also of great concern. Scholars are particularly interested in the sustainability of the Chinese economy in the future due to its rapidly ageing population. Authors of many extant studies have explored the effects of the vanishing first demographic dividend and the arrival of Lewis turning point in China (Wang and Mason, 2006; Wang, 2007; Cai, 2010, 2011; Zhai and Yang, 2011; Wang, 2012). These scholars are of view that the disappearance of China's first demographic dividend would have detrimental effect on the economy in the future (Li, 2009; Peng, 2012). Some scholars posit that the first demographic dividend in China has already disappeared, basing this assessment on the negative growth in labour force and the acceleration in the population ageing, due to which demographic dividend has become demographic debt

(Cai, 2004; Wang, Mason and Shen, 2006; Wang, 2007). Yet, other scholars argue that the dependency ratio, while rapidly increasing, is still much lower than that noted in the 1980s and 1990s, indicating that China would be in the demographic window period until around 2030 (Yu, 2003; Chen, 2005). Nonetheless, empirical evidence indicates that the total dependency ratio in China has been increasing, mainly resulting from the significant increases in the old-age dependency ratio, due to which the economy and society will be experiencing a growing dependency burden in the future (Figure 1.2). Thus, it is necessary to analyse the population ageing process and discern its impacts on the economy in the country.

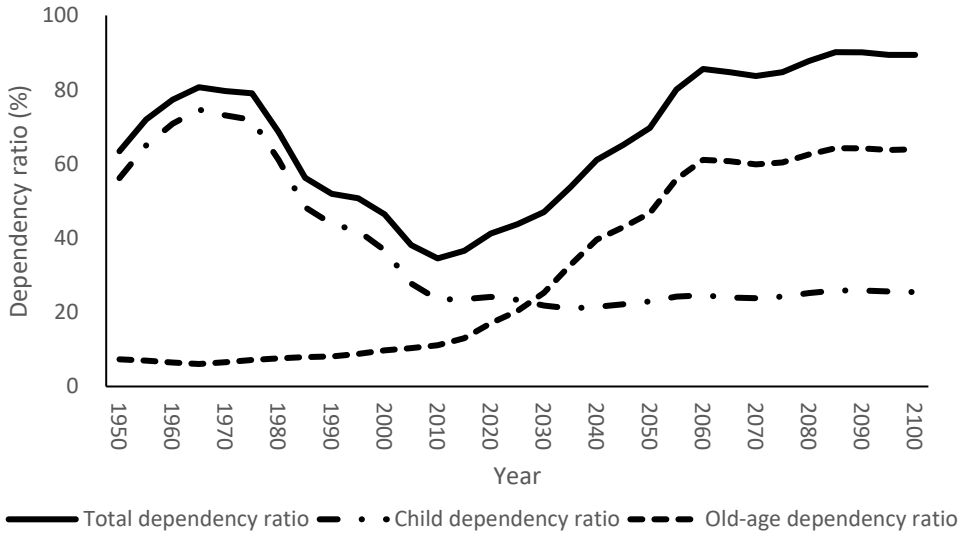

Figure 1. 2 Dependency ratios in China, 1950-2100

Sources: United Nations, Department of Economic and Social Affairs, Population Division. 2015. World Population Prospects: The 2015 Revision, DVD Edition.

The aims of the study reported in this thesis are to investigate China's demographic future, the population ageing in particular, and to examine the impacts of ageing on labour force supply, household savings and consumption in the country. Furthermore, the effects of the two-child

policy implemented in 2016 by the Chinese government as a response to its changing population were also examined. To meet these objectives, a simulation model was developed to explore the changes in women's fertility rates under the two-child policy, which provides an approach to estimate the fertility rates under sudden policy adjustments. This was followed by analyses focusing on the demographic future in China under the two-child policy using cohort component projection method. In addition, the impacts of population ageing on labour force supply were investigated, including labour force participation rates, the productivity, and the size and structure of the labour force. Moreover, the effects of population ageing on household savings and consumption were analysed from both macro and micro perspectives. The analyses reported in this thesis therefore make a significant contribution to the related literature and the findings yielded deepen the understanding of population ageing and its impacts on the economy in China.

1.2 Key concepts

1.2.1 Demographic transition

Demographic transition theory was developed to explain the process of demographic changes resulting from the socio-economic development based on the experiences in Western countries during the eighteenth and nineteenth century, which depicts the changes or demographic transitions in birth and death rates over time (Shi, 2012). Specifically, application of this theory allows delineating the transition process of the reproductive patterns of a given population, whereby a pre-modern one characterised by high birth rates and high death rates is replaced by a post-modern one with low birth and low death rates, accompanied by the socio-economic development. The demographic transition theory describes not only the demographic changes

during the development of human society, but also outlines the corresponding socio-economic factors and outcomes of these changes.

Demographic transition was first discussed by Adolphe Landry in 1909, who analysed the population development in Europe, resulting in the theory development by Warren Thompson in 1929, which was refined in 1945 by Frank Notestein with the introduction of "transition" concept (United Nations, 1990). During the second half of the eighteenth and in the nineteenth century, Europe experienced an unprecedented socio-economic reform, referred to as Industrial Revolution, which has had profound implications for the European population. During this period, the birth rates initially increased, but soon started declining at a rapid rate. This was accompanied by a sharp decline in death rates due to the advances in medicine and other scientific fields (Davis, 1945; Lee, 2003; Dyson, 2010). Based on observations made in Europe, Landry divided the population changes into three stages, which allowed all the countries in the world to be divided into three groups based on the population growth patterns during 1908−1927 (Warren Thompson, 1929). This resulted in the classical three-Stage demographic transition theory, which transformed spatial perspective into temporal perspective, describing population changes over time. More specifically, stage one is characterised by high fertility rates and high mortality rates, while both fertility rates and mortality rates begin to decline in stage two, leading to stage three, characterised by fertility rates at the replacement level or below (Notestein, 1945).

Throughout the history, demographic transition processes have been occurring all over the world, albeit at different times and rates. For example, the demographic transition process in developed countries occurred much earlier than in developing countries. It commenced during the Industrial Revolution in 18th century, with all three stages completed around the middle of

the 20th century (Li, 2000; Dyson, 2010). The demographic transition in developing countries is unique in its characteristics (Mason, 2005; Yang, 2012). Since the 1950s, following the end of World War II, the death rates in developing countries declined rapidly, form around 50 deaths to 10 per 1,000 persons at the end of 20th century (United Nations, 2013). When compared with the developed countries, the demographic transition process in developing countries occurred later, but much faster, benefiting from the medical and technological advances.

China is the most populous country in the world, as its population comprises about 20% of the world population (UN, 2015). Consequently, its demographic transition process is an important part of the world's demographic transition, demanding that it be examined in the context of the demographic transition theory. From the foundation of the regime, China began its mortality decline in the 1950s, which indicated the initialization of its demographic transition process. However, the decline in fertility rates in the country was much later, about in the 1970s. Before the 2000s, the Chinese population completed its demographic transition, which took less than half one century. Specifically, Chine completed the demographic transition process in a much shorter period, while most European countries took hundreds of years to progress through all the stages aforementioned (Chen, 2008; Yu, 2009; Yang, 2012). When compared with developed countries, and even with other developing countries, the demographic transition in China was much faster, largely owing to government intervention and birth control policy in the country. During the demographic transition process, the birth control policy plays a crucial role in the sharp fertility rate decline (Lin, 1987; Peng, 1991; Scharping, 2003; Greenhalgh and Winckler, 2005; Yu, 2009; Wang, 2012). This rapid demographic transition process in China contributed to the building of an advantageous population base for the economy, which is argued to benefit the economic growth through abundant and cheap labour force and

continuously declining dependency ratios (Wu, 1999; Wang et al. 2004; Wang and Mason, 2005; Che and Guo, 2011).

1.2.2 Demographic dividend

Demographic transition theory can be applied to describe the demographic changes rooted in socio-economic development in human society, as it reveals the close association between population changes and socio-economic factors. However, many scholars, especially economists, recognise that the demographic factors, particularly population age structure, generate another essential mechanism in delivering economic returns for a country, except for capital and natural sources. Demographic dividend theory was developed based on this premise, the aim of which was to generalise the powerful effects of population age structure on economic growth (Bloom and Williamson, 1998). The demographic dividend, also known as demographic window or demographic opportunity, refers to a period during which the proportion of working-age population is particularly prominent in the given population. This period usually lasts for several decades (Bloom, Canning and Sevilla, 2003), and is characterised by the ability to address imbalance between economic production and consumption to generate great economic effect (Bloom and Williamson, 1998; Mason, 2001). The United Nations Population Fund provides a much more specific definition for demographic dividend, "Countries with the greatest demographic opportunity for development are those entering a period in which the working-age population has good health, quality education, decent employment and a lower proportion of young dependents. Smaller numbers of children per household generally lead to larger investments per child, more freedom for women to enter the formal workforce and more household savings for old age. When this happens, the national economic payoff can be substantial. This is a 'demographic dividend'" (UNFPA, 2016).

Demographic dividend, while providing favourable conditions for economic growth, is often affected by low participation rates or rampant unemployment, and poor institutional support (Lee, 2006). In China's case, the country experiences good practices in grabbing its demographic dividend, as evident in its 20-25% contribution to the economic growth (Wang et al. 2004; Bloom and Finlay, 2009).

As most countries worldwide have been experiencing population ageing and prolonging in life expectancy, the second demographic dividend was recently proposed (Lee and Mason, 2007). While the first demographic dividend is based on the positive effects of young population and thus abundant labour force on economic growth, the second demographic dividend is created by the increasing savings due to the uncertainty regarding income in the future and the reallocation of income during working-age period. Authors of extant studies examining the second demographic dividend addressed this phenomenon mainly from a theoretical perspective or through qualitative analyses, failing to provide empirical evidences and quantitative support for their findings (Mason and Lee, 2006; Wang and Mason, 2006; Cai, 2010; He, 2013; Wang, Deng and Wang, 2016).

1.2.3 Fertility policies in China

The birth control policy plays an important role in China's population development, which contributes to a much more rapid and shorter demographic transition process, compared to developed countries (Chen, 2006; Yu, 2009; Wang, 2012). In the early years of the regime, around the 1950s, influenced by Mao's thought "a large population is a good thing", the government tended to encourage population growth, which was evident in government documents with prohibition of illegal abortion (NPFPC, 1950). However, the result of the first population census in China showed that the population size had been up to more than 500

million, which clearly revealed the burden and challenge of rapid population growth (NBS, 1985). The Chinese governments afterward realized the pressure of rapid population growth on the economy. The Premier of Zhou Enlai pointed out this issue in one government working conference in 1953, and Deng Xiaoping further thought it was necessary to encourage conception (National Population and Family Planning Commission, 2007). Therefore, China was one of the first countries in the world to recognise the population pressure on economic growth, the government's attempts to control population could be traced back to the 1950s (Zhai et al., 2011). However, due to the poorly developed economy and lack of modern technology, the government was not equipped to deliver effective measures to control its population at that time. In the 1960s, Chinese government established an official institution in charge of birth control, as well as appointed related offices at the provincial and local levels (Poston, Lee, Chang, McKibben and Walther, 2005). During this period, hospitals and health agencies focused on disseminating contraceptive knowledge, and providing birth-control technologies and methods. Unfortunately, this birth control campaign was disrupted by the political upheaval of the Great Cultural Revolution during the 1966−1976 period.

The actual birth control policy in China was effectively implemented in the early 1970s, which was described as "late, sparse and few", and decreased precipitously the fertility rates in both rural and urban areas (Poston et al., 2005; Yu, 2009). Encouraged by the success of the birth control practices in the 1970s, the Chinese government adopted a radical one-child policy in 1979, aiming to limit the population to 1.2 billion by 2000. As a result, the total fertility rate declined from 5.8 in 1970 to 2.24 in 1980, with the natural growth rate declining from 28.8‰ to 11.9‰ (Yao and Yin, 1994). During 1980 to 1984, the fertility policy in China further developed from "late, sparse and few" to the one-child policy, which regulated Chinese couples

could only have one child, except for minority nationality (Feng et al., 1999). However, the rigid demand of one child per couple was faced by strong resistance, especially in the rural areas where having large families was a common practice. Consequently, the Chinese central government was forced to revise its one-child policy in 1984, allowing the provincial and local authorities the option of permitting a second child if the first child was a girl, which was called the one-and-a-half child policy (Gu et al., 2007). In the following years, the Chinese governments made some minor changes in the fertility policy, such as cancelling the control on birth intervals, allowing *shuangdu* couples to have two children, etc.

After thirty-year implementation of the so-called one-child policy, at the end of 2013, the Chinese government adjusted its fertility policy to the selective two-child policy, which allows *dandu* couples to have a second child. In 2016, the government implemented the universal two-child policy, allowing all Chinese couples to have two children. Owing to these changes, the aim of the present study was to examine the country's demographic future in the next four decades, in the view of the two-child policy in China.

1.3 Research questions

In order to achieve the aforementioned objectives, the study was guided by the following research questions:

(1) What demographic future will China be confronted with under the two-child policy?
   i) Through what mechanisms would the sudden policy adjustments affect women's fertility rates in China?
   ii) What demographic consequences would the two-child policy have in China in the future?
   iii) What would the ageing population be in size and proportion in the future in China?
   iv) When would the first demographic dividend diminish in China?

(2) To what degree and through what mechanisms will population ageing affect the labour

force supply in China?

i) What changes and challenges are facing the labour force in China?

ii) To what extent does population ageing affect the labour force participation rates?

iii) What changes would the labour force undergo in China due to the rapidly ageing population?

(3) What impacts does population ageing exert on household savings in China?

i) What is the relationship between population ageing and household savings rate in China at the macro level?

ii) What effects would the ageing within households and supporting old parents make on household savings at the micro level?

iii) Through what mechanisms would population ageing affect household savings in transitional China?

(4) What effects does population ageing have on household consumption patterns in China?

i) What influence does population ageing have on the Chinese household consumption patterns at the macro level?

ii) What effects would population ageing and the growing need to support elderly parents have on the Chinese household consumption patterns?

iii) Through what mechanisms does ageing affect the Chinese household consumption at the micro level?

iv) What is the link between population ageing and household consumption structure in China?

1.4 Data and methodology

1.4.1 Data sources

Multiple sources of data were utilised in this study, including both macro- and micro-level data. The macro-level data were mainly sourced from 1% national population sample surveys and population censuses in China, the national, provincial and municipal statistical yearbooks published by the National Bureau of Statistics, Provincial Bureau of Statistics, and Municipal Bureau of Statistics in China. In addition, the data employed in the present study also include

micro-level data from the China Family Panel Studies survey conducted in 2010 by the Institute of Social Sciences Survey (ISSS) at Peking University and is funded by the Chinese government research grants.

The macro-level data utilised in this investigation, as noted above, were sourced from 1% national population sample surveys conducted in 1987, 1995, and 2005, along with the population censuses performed in 1982, 1990, and 2010 in China. As a part of these population sample surveys and population censuses, detailed information on age-specific fertility rates of Chinese women was collected, including specific fertility rates for each parity. Thus, these data sources allow establishing fertility history of women of childbearing age in each cohort in the country, which is utilised in the analysis reported in Chapter 2. Moreover, the present study benefitted from other macro-level data yielded by the population census in China, which was used in making population projections reported in Chapter 2 and Chapter 3, including age-sex-specific population data, life expectancy at birth, sex ratio at birth, and age-specific labour force participation rates. In addition, the macro-level data from national, provincial and municipal statistical yearbooks were employed in this investigation, mainly for the macro-level investigation on the impacts of population ageing on household savings and consumption, discussed in Chapter 4 and Chapter 5 of this thesis.

The micro-level data adopted in the present study were obtained from the China Family Panel Studies survey conducted in 2010, which is a nationally representative, annual longitudinal survey of Chinese communities, families and individuals by the ISSS in China. The survey is designed to collect individual-, family-, and community-level longitudinal data in contemporary China, focusing on the economic, as well as non-economic, wellbeing of the Chinese population. It thus provides a wealth of information on a variety of topics, such as

economic activities, educational outcomes, family dynamics and relationships, migration, and health (Xie and Hu, 2014). The survey waves used in this study were conducted in 2010 and 2011, with samples of about 15,000 households and 36,600 adult individuals. Based on the micro-level data generated by these surveys, as a part of the present study, the impact of ageing on household savings and consumption was examined at the household level, in addition to exploring the mechanisms through which ageing affects the Chinese families' economic behaviours, as reported in Chapter 4 and Chapter 5.

1.4.2 Methodology

The present study was mainly based on quantitative approaches, both demographic and econometric, as this allowed analysing China's population ageing and its impacts on the economy in the country. Using these approaches, the Chinese demographic future under the two-child policy was projected, focusing specifically on its population ageing process, while also exploring the impacts of ageing on labour force supply. In addition, the effects of ageing on Chinese household savings and consumption patterns were investigated from both macro and micro perspective.

The second chapter in this thesis is dedicated to the examination of the two-child policy effects on the fertility rates and its demographic consequences in China. However, using the traditional approaches does not allow for making accurate estimation of influence of sudden policy adjustments on women's fertility rates (Guo, 2004; Wang, 2015). Thus, to overcome this issue, in the present study, a cohort simulation model was developed to estimate women's fertility rates after implementing the two-child policy in China. The model and its outputs enhance the understanding of the mechanisms though which the policy adjustments affect women's fertility rates and allow estimating the Total Fertility Rate in the future. In Chapter 2,

cohort component population projection method is utilised to examine the Chinese demographic future under the two-child policy, including annual births, population size, age structure, and population ageing in the next four decades. In addition, the population projection method and the standardisation method are employed to investigate the Chinese labour force supply, as discussed in Chapter 3.

In Chapter 4 and Chapter 5, the system Generalised Method to Moments (GMM) estimation is employed for the analysis of impacts of population ageing on household savings and consumption from the macro perspective. The correlations between the explanatory variables and disturbance terms indicate the problematic usage of traditional Ordinary Least Squares (OLS) regression models in consistent estimation of parameters (Mileva, 2007). Moreover, classical Fixed Effect model and Random Effect model also meet difficulties in providing unbiased estimation of parameters in a dynamic panel data, which are usually affected by unobserved individual specific heterogeneity and autocorrelation issues (Nerlove, 1971). Sequential moment conditions should thus be utilised, allowing lagged levels of the explanatory variables to be treated as instruments for the endogenous differences, which is developed as the first differenced GMM method (Arellano and Bond, 1991). However, empirical evidence indicates that the first differenced GMM estimator has very poor finite sample properties in terms of bias and precision when the series are persistent, as the instruments are weak predicators of the endogenous changes (Blundell and Bond, 1998; Bun and Windmeijer, 2009). In order to overcome these shortcomings, the system GMM method was developed with the usage of extra moment conditions that rely on certain stationarity conditions of the initial observations (Arellano and Bover, 1995; Blundell and Bond, 1998). Comparatively, the system GMM method exhibits much better finite sample properties in terms of bias and root mean

squared error than the first differenced GMM estimator (Blundell and Bond, 1998; Blundell, Bond and Windmeijer, 2001). In the macro analyses presented in Chapter 4 and Chapter 5, the lagged levels of dependent variables (household saving rate and consumption rate) are included in the model, which would undoubtedly produce endogeneity. Consequently, the system GMM method was employed in this study to provide unbiased and consistent estimation of the parameters.

Finally, the Hierarchical Linear Model (HLM) and Binary Logistic Regression model were employed for the micro-level analysis reported in Chapter 4 and Chapter 5, the aim of which was to investigate the influence of ageing on household savings and consumption at household level. Considering the explanatory variables at multiple levels, including provincial, community-, and household-level, the HLM approach is more suitable for analysing the extent to which population ageing affects household savings and consumption. In addition, one of the dependent variables referred to in Chapter 4 is measured based on "whether the household deposited money in the last year", which is thus a dichotomous variable, requiring the adoption of Binary Logistic Regression model.

In summary, the results from the analysis using these approaches will enhance the understanding of China's demographic future under the two-child policy, and will elucidate the impacts of population ageing on the economy through the underlying effects on the labour force supply, as well as household savings and consumption. Thus, the findings from the present study make a pertinent contribution to population ageing literature. The evidence-based analysis also contributes to the formulation of policy reform in response to the rapid population ageing in China.

1.5 Contributions and limitations

1.5.1 Research contributions

The study reported in this thesis has both theoretical and practical contributions. From the theoretical perspective, the findings generated by the present study empirically extend the application of population economic theory, family economic theory, and life cycle theory in China, with a particular focus on the effects of population ageing. Owing to the rapid population ageing and the significant changes in the country's economy, which is presently in transition, it is essential to explore the relationship between population ageing and economic growth. As population ageing and economic development in China bear some unique characteristics due to its institutional, cultural and political backgrounds, the exploration increases the current understanding of the impacts of population ageing on economic growth. On the other hand, the analysis of population ageing and economic growth from both macro and micro perspectives contributes to the current body of literature by extensively examining the interrelationships between population ageing and the key elements of the economy, as well as the impacts of population ageing on households.

The study reported in this thesis contributes to a better understanding of the role of population ageing in the economic growth in China. Through the macro-level data analysis, the application of life cycle theory in China is extended, owing to the inclusion both the old-age dependency ratio and the old population growth rate into the analysis. The positive effects of old-age dependency ratio on aggregated savings supports the applicability of the life cycle theory in China. However, analysis on the effects of the growth rate of elderly population on aggregated household savings provides evidence that counters this theory. This incongruence is posited to stem from the unique intergenerational relationships in China, whereby parents are

expected to provide financial support to adult children through childcare or wealth transfer. The micro-level analysis of relevant survey data further improves the understanding of ageing and household savings at the household level, while also supporting the macro-level analysis results. In the Chinese context, ageing of household members is expected to decrease savings in the households, which are complemented by adult children supporting their elderly parents. Both of these phenomena are supported by macro- and micro-level evidence. In addition, raising young children exhibits a significant and positive effect on household savings rates, in accordance with the life cycle theory. In the present study, specific focus was given to the role of population ageing in increasing or decreasing household consumption levels in China. The aging within the household structure is posited to significantly reduce the consumption rate, while supporting elderly parents increases the consumption per capita.

In addition to theoretical significance, this thesis contributes to the methodological development in regarding to fertility simulation as well. To overcome the shortcomings of traditional methods and investigate the influences of the two-child policy on fertility rates, this study develops the improved simulation model, providing comprehensive results of women's fertility rates under the two-child policy, taking women's fertility history, fertility desire, cumulative effect of second births and other factors into consideration. The analysis contributes to a better understanding of changes in fertility rates in China, by capturing the effects of sudden policy adjustments on women's fertility behaviours and patterns, an area that has not previously been adequately understood. The study explores the mechanisms, through which the two-child policy affects women's fertility rates, and treats two groups of women separately in the simulation model. With two specific equations, this study simulates the age-specific fertility rates of women in each cohort under the two-child policy from the perspective of cohort, with

estimations of additional births from the relaxed policy and historical cumulative effect of second births. It then estimates the period fertility rates (TFR) by summarising the age-specific fertility rates of each age group in one given year. This model provides an approach of estimating period fertility rates after a sudden policy adjustment in a country or region, where fertility policies are designed to regulate number of children women could have over their lifetime. This study fills a void in the field, contributing methodological significance in demographic research.

In addition to the theoretical significance, the findings reported in this thesis also have practical implications by providing insights into the effects of fertility policy adjustment, population plans and reforms in the social welfare system. In the present study, it is hypothesised that the implementation of the two-child policy would result in a temporary, albeit drastic increase in fertility rates, as this effect is indicated by the simulation model developed as part of this research. The model output can be used to forecast the demographic changes under the two-child policy in China in the next three to four decades, including labour force supply, dependency ratios, and population structure. The findings contribute to the knowledge of changes in a number of demographic indicators under two-child policy, including fertility rates, population size, age structure, labour force supply and population ageing, which provide a better understanding of the demographic future in China. In addition, the shortage in labour force supply and the increasing costs of labour force in the country require further economic reforms to boost the economy in the future, including reducing the dependence on exports of low-cost products, and restructuring the labour-intensive industries into technology- and innovation-driven ones.

1.5.2 Research limitations

As any study of this nature, the current research also suffers from some noteworthy limitations. The first limitation stems from the measurement of household savings, and specifically from the data sampling adopted in this research. Ideally, household savings should be defined as the difference between a household's disposable income (wages, income of the self-employed, and the net property income) and its consumption level. However, the information on the household disposable income could not be discerned from the survey data, mandating that the responses to the questions such as "Did the household deposit money in the last year?" and "What was the bank balance for the whole household at the end of the last year?" be used to measure household savings. It is, however, likely that this approach would result in underestimating the household savings due to the existence of other financial products.

The other limitation of the present study pertains to the paucity of existing studies on intergenerational disparities in consumption patterns, both in their extent and structure. The analysis of household consumption discussed in Chapter 5 is based on the observations conducted during the 1997−2010 period, which is inadequate for accurately discerning the impact of ageing on consumption patterns that would emerge once the young population enters old age.

The last limitation affecting the utility of the findings in this research relates to the focus on the relationship between population ageing and household economic behaviours, without considering the effects of intergenerational wealth transfer. However, intergenerational wealth transfer plays an important role in household economic behaviours, including savings and consumption (Barro and Macdonald, 1979; Kotlikoff, 1987; Modigliani, 1988; Modigliani and Cao, 2004).

1.6 Structure of this thesis

This thesis comprises six chapters. It adopts the format of Thesis by Publication, as regulated by the Macquarie University PhD thesis rules.

With the exceptions of the first (introduction) and the last (conclusions) chapter, the remaining four chapters are written as self-contained independent papers for consideration for publication in academic journals. The content of Chapter 2 has already been submitted to *Population Studies*, while material in Chapter 5 has been presented at the Australian Population Association conference in December 2016, and is ready for submission to *Population and Development Review*. The content of Chapter 3 and 4 is under preparation for submission to academic journals as well.

Chapter 1 is designated for an extensive review of the research background, introducing the key concepts of relevance for the present study, research questions, data sources, methodology, as well as the research significance and study limitations.

In the next chapter, Chapter 2, the demographic future in China following the introduction of the two-child policy in 2016 is examined. The simulation model developed to estimate women's fertility rates under the two-child policy in China is introduced first, as this model is subsequently employed to explore the influence of sudden policy adjustments on fertility rates. Based on these the fertility rate estimations, analyses proceed to the demographic consequences of the new fertility policy in the next three to four decades in China, including the changes in annual births, population size, population age structure, and ageing. This chapter closes with the investigation of the overall impact of the two-child policy on China's population.

In Chapter 3, the relationship between population ageing and labour force in China is examined. This chapter commences with the review of the changes and challenges in labour

force China is presently facing. This is achieved by analysing the macro-level data sourced from national statistical yearbooks, focusing on the changes in size and age structure of labour force in China, while also including productivity, labour force participation rates, and the wages of employed population. In the next sections, the influence of labour force ageing during the 2000−2010 period is examined. Using the direct standardisation method, the effect of labour force ageing on the declining participation rates is estimated. Finally, this chapter closes with the projections of the labour force supply for the next three to four decades, along with the discussion of the impact of the ageing labour force on China's economic growth.

Chapter 4 is dedicated to the analyses of population ageing and household savings in China, which are performed from both macro- and micro-level perspective. The chapter commences with the discussion on the population ageing and savings rates in China. This is followed by the examination of the relationship between population ageing, measured by the old-age dependency ratio, and the population aging rate, and aggregated savings rates in China. For this analysis, the GMM model is adopted, utilising provincial panel data for the 1997−2010 period sourced from national and provincial statistical yearbooks as its inputs. Next, the effects of ageing on household savings and mechanisms through which ageing affects household savings are analysed from the micro perspective, using the Binary Logistic regression model an HLM method based on the survey data yielded by the China Family Panel Studies conducted in 2011. In this chapter, the different effects of ageing within households on the saving behaviours are explored separately, including presence and absence of saving, and their amounts.

In Chapter 5, the impacts of population ageing on household consumption patterns are explored. Firstly, changes in domestic consumption rates in China are reviewed. This is followed by the investigation of the impact that population ageing exerts on aggregated

household consumption rates from the macro perspective, adopting GMM model based on provincial panel data. To gain a better understanding of the relationship between population ageing and household consumption rates, the effects of ageing on household consumption patterns are analysed using the Hierarchical Linear Model based on micro-level data, which examines the influences of aging within individual households and the need for supporting elderly parents on household consumption. Finally, the chapter closes with an investigation of the consumption patterns of different age groups using Grey Related Analysis.

The thesis closes with Chapter 6, where the main conclusions derived from the study are presented. After summarising the key findings reported in each chapter, the implications of this study are delineated, and the directions for future research in the field proposed. In appendices, a number of useful and detailed materials, such as the specific assumptions used in the population projections, and the questionnaires of the China Family Panel Studies survey, are attached.

Chapter 2 China's Demographic Future under the Two-Child Policy

2.1 Introduction

Over the past half century, China witnessed profound changes in its population. In the 1950s, the country had a young population with a large proportion of children and a small share of the elderly. The total population of mainland China reached about 594 million in 1954, in which the proportion of children aged 0–14 was 36.3% and the share of elderly people aged 65 and above was only 4.4% (NBS, 1985). However, China's population presented a significantly different shape in 2015. A recent report released by the National Bureau of Statistics stated that the total population of China in 2015 increased to 1.37 billion, with an annual growth rate of 1.39% in 1949-2015. The proportion of children aged 0–14 declined to 16.5%, whereas the share of elderly people aged 65 and above grew to 10.5% in 2015 (NBS, 2016). In fact, China has completed its demographic transition process in three decades since the 1970s, from a pre-transition regime of high fertility and high mortality to a post-transition one in which both rates are low (Li, 2000). Compared to Western countries that completed the process in one hundred or more years, China experiences a much shorter and more rapid process (Yuan, 2001), which consequently causes drastic changes in its fertility, mortality and age structure.

The restrictive birth control policy in China plays a significant role in its demographic transition process, in addition to from the social and economic factors (Kirk, 1996; Li and Guo, 2007; Cai, 2010; Cai, 2010; Peng, 2011; Wang, 2012). The actual birth control policy in China was effectively implemented in the early 1970s, which as featured as "late (age at marriage), sparse (longer birth interval) and few (number of children)" and decreased precipitously the fertility rates in the country. Encouraged by the success of the birth control practices throughout

the 1970s, the Chinese central government eventually adopted its ambitious and radical one-child policy in 1979 (Poston et al., 2005; Yu, 2009). The rigid regulation of one child per couple ran into strong resistance, especially in the rural areas where shared the traditional value of having large families and son preference. Consequently, the Chinese central government was forced to revise its one-child policy in 1984, and allowed the provincial and local authorities the options of permitting a second birth if the first child was a girl (Poston et al., 2005). Specifically, the majority of the Chinese population (more than 70 percent) lived in areas with a policy fertility level at 1.3 to 2.0 children per couple in the 1990s (Gu et al., 2007). Due to the effective implementation of the one-child policy, China saw a sharp decline in its fertility rates, with the TFR descending from 5.8 in 1970 to around 1.5 in 2010 (Yu, 2009; Jin, 2014; Chen, 2016). Consequently, the policy makes profound implications on the size and growth of the population, reducing the number of the total population by three hundred million during the period (Yang et al., 2000; Chen and Zhuang, 2004; Tao and Yang, 2011). In the meantime, the one-child policy improves women's health and social status, and sets women free from high fertility rates in fact (NPFPC, 1995; Zheng, 1996; Pang, 2014; Lu and Zhang, 2016). The policy increases the Chinese women's contraception rate by disseminating contraception knowledge, techniques, and methods (Tao and Yang, 2011). In 2015, the percentage of married women aged 15–49 using contraception in China was 85%, much higher than the world average of 62%, and the average in developed countries of 67% (PRB, 2015).

However, the sustained long-term and strict implementation of the one-child policy made considerable negative effects on Chinese population as well, including the low fertility rates in recent two decades, the enlarging imbalance of sex ratio at birth, the rapid population ageing process, and the decreasing labour force supply in the future (Ebenstein, 2010; Cai, 2011; Ma

and Gui, 2012; Yang and Zhai, 2012). The changing demographic consequences attract intensive attentions among the academia and policy-makers, launching heated debates on fertility policy adjustments in China (Zeng, 2007; Chen, 2008; Bao, 2009; Wang and Zhao, 2012; Zhai, Zhang and Jin, 2014). Dating back to the early 1990s, some scholars pointed out that China should take immediate actions to deal with its future demographic issues through relaxing its fertility policy (Greenhalgh and Bongaarts, 1992; Li, 1997; Chen, 1999). However, other scholars argued that an increase in fertility rate would ensue if the policy were relaxed in the 1990s or early 2000s considering Chinese women's high fertility desire, especially in rural areas (Ye, 2002; Li, 2007). After 2010, most demographers in China agreed that the country should gradually relax the fertility policy to improve its demographic situations in the future (Xu, 2009; Shen, Wang and Cai, 2012; Tang, 2013; Yin, Yao and Li, 2013; Liu and Tang, 2015; Qiao, 2015). At the end of 2013, the Chinese government began its first step on adjusting the fertility policy by allowing all *dandu* couples (in which wives or husbands are only child) to have a second child, which is called the selective two-child policy. Consequently, the Chinese women's fertility rate in 2014 was slightly increased after implementing the selective two-child policy, mainly in second births (NBS, 2015). As shown in Figure 2.1, Chinese women aged 20-30 significantly increased their second births in 2014 under the policy.

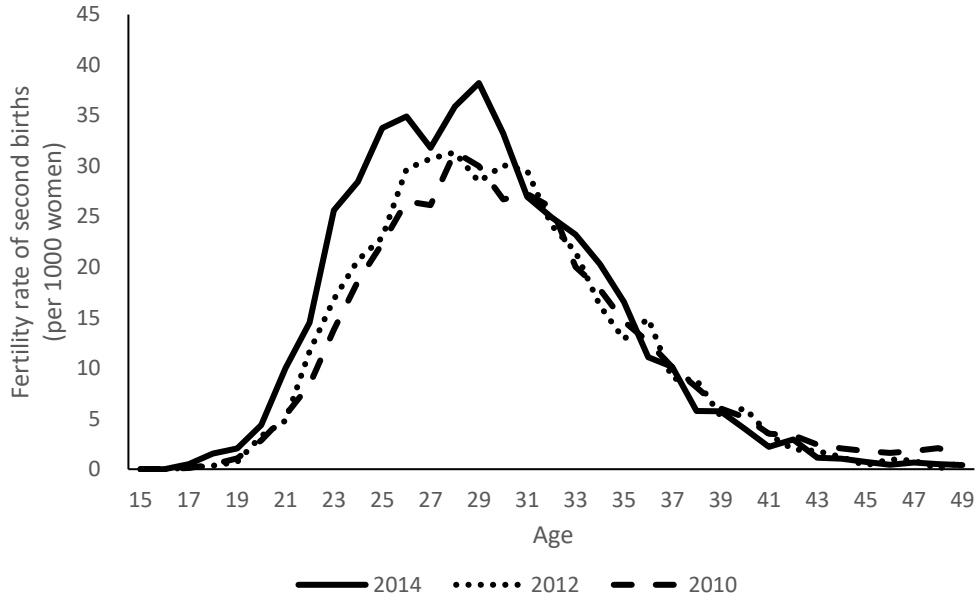

Figure 2. 1 Fertility rates of second births in China, 2010, 2012 and 2014

Sources: National Bureau of Statistics of China. 2016. China Statistical Yearbook 2015. Beijing: China Statistics Press.

The selective two-child policy is a temporary and transitional design between the one-child policy and the universal two-child policy in the country. In 2016, the Chinese government further adjusted its fertility policy, allowing all couples to have two children over their lifetime. Plentiful studies have been done related to the topic of the two-child policy in China, which particularly focus on the feasibility of implementing the two-child policy and its ensuing demographic consequences in the future, without consensus in the effects of the new policy. Some scholars argued that implementing the two-child policy would bring sharp increases in women's fertility rates and annual births, leading to a growing labour force in the future and slowing the ageing process (Zhai et al., 2014). However, other researches hold the viewpoint that China's fertility rate wouldn't rise substantially even with an immediate implementation of the two-child policy, considering the high costs of raising children and women's low fertility

desire in the country (Zheng, 2004; Wang and Zhang, 2012; Wang, 2015). Moreover, the influence of the two-child policy on women's fertility rates has not been adequately understood in literature. In the finite number of previous studies, some research simply assume that the fertility rates would precipitously rise to the replacement level (two) after implementing the two-child policy (Qiao and Ren, 2006), which is impractical and lack of evidence-based support. Some other scholars project the fertility rates under the two-child policy based on the essential parameter of fertility desire, which comes from survey data (Zheng, 2004). However, most individual surveys adopted in previous studies were organized under the one-child policy, which indicates that the responses of interviewees would be affected by the policy environment at that time. Furthermore, the parameter of fertility desire used in analysis previously is defined as the proportion of women with the desire for having a second birth in total female population, without inclusion of age structure, marital status and fertility history (Feng and Zhang, 2002; Zheng, 2004; Ma and Hou, 2008). The existing limitations in previous studies contribute an inadequate understanding of the effects of the two-child policy on women's fertility rates. Some pioneering research discuss about the measurement of women's fertility rates under policy adjustments and conclude that traditional projection or simulation methods are poor in providing accurate estimations of the influences of sudden policy adjustments on fertility rates (Guo, 2004; Wang, 2015). Parity progression model is suggested to be adopted in related studies on the topic, which is also challenged by the data quality of detailed fertility information in China and unavailability of age-specific fertility pattern under the new policy (Guo, 2004). In this context, it is of growing significance to develop new methods or models to analyse the effects of sudden policy adjustments on fertility rates.

In this study, we aim to examine China's demographic future under the two-child policy employing a new model, which can overcome the limitations discussed above and can also simulate different scenarios of women's fertility rates under the new policy. First, the result reported in this chapter explores the mechanisms through which the fertility policy affects fertility rates in China, which highlights the rationale of the model developed for fertility rates simulation under the two-child policy. Second, this study develops the simulation model based on the review of contributing factors to fertility rates, including women's age-specific fertility rates, fertility desire, timing distribution of second births, effects of the two-child policy on second births, and cumulative effect on second births. It then investigates the demographic consequences of the two-child policy in China in the next three to four decades, including annual births, population size, labour force supply, and population ageing. With analysis on China's demographic future under the two-child policy, this study provides evidence-based analysis that contributes to the evaluation of the new policy and the formulation of government's policy-making in the future.

2.2 Fertility policy and women's fertility rates in China

Previous studies conclude that fertility rates are mainly determined by two factors: one is socioeconomic development and ensuing changes in fertility desire (Davis 1963; Blake 1965; Bongaarts, 1978); and the other is policy factor (Berelson, 1969; Kirk, 1969). The conclusions are applied well in China's case. During the period of the 1950s to 1960s, prior to the family planning program implementation, the fertility decline initially started in large cities and urban regions among educated women in China. Urban fertility began to fall in the 1960s, arising from achievement in education attainments, improvement in women's labour force participation, reduction in infant mortality rate, and adoption of contraceptives among urban

women (Lin, 1987; Peng, 1989; Peng and Huang, 1993; Li, 2003). During this period, the fertility decline in the better educated strata in China urban areas was under way well before the introduction of major government birth control programs, which instead was closely associated with education and urbanization (Lavely & Freedman). In the early 1970s, the Chinese government implemented the birth control policy, which effectively influenced fertility rates in the country. Along with the socio-economic development, the policy accelerated the decline in fertility rates. Specifically, China's ambitious and strict fertility policy significantly contributes to the sharp decline in women's fertility rates during the past several decades (Li, 2004; Chen, 2005; Chen, 2008). As designed, the fertility policy in China restricts the number of children each couple could have over their lifetime, but it doesn't strictly regulate the timing when each couple gives births (in the past some authorities at provincial and local level in China regulated the birth intervals or age of births, which mostly had been abrogated). This policy design indicates that China's fertility policy directly restricts women completed cohort fertility rates rather than period fertility rates. However, the parameter of period fertility rate is the prerequisite in population projection studies, especially in analysis using cohort component projection method. Sudden policy adjustments would lead to an enlarging gap between period fertility rates and cohort fertility rates in a short period after implementing the two-child policy, due to the sudden increase in the number of annual births under the new policy, which also indicates that the assumption of fertility rates with value of two in previous studies is unconvincing. To estimate the fertility rates under the two-child policy, the study needs to build the linkage between women's cohort fertility rates, which is directly restricted by fertility policy, and period fertility rates.

To further explore the rationale of fertility rates and policy adjustments in China, the study reported in this chapter defines two groups of women based on the time when the women step into childbearing ages, who would be treated separately in the simulation model. The first group of women are those who enter the childbearing ages (15-49) before the implementation of the two-child policy (lower triangular region in Figure 2.2), and the second groups of women are those who step into childbearing ages after the implementation of the two-child policy (upper triangular region in Figure 2.2). Specifically, the first group women are cohorts who were born during 1967-2001, and the other group of women are cohorts who were born after 2002. These two groups of women would experience different cohort fertility patterns during their reproductive ages due to the policy adjustments and changes in policy environment.

For the first group of women, who entered childbearing ages before the implementation of the two-child policy, they experienced the cohort fertility pattern under the one-child policy in the past and would undergo a new cohort fertility pattern under the two-child policy in the future. Before 2016, some of these women had a strong desire to give two births, which is restricted by the fertility policy due to failure to meet policy requirements. For instance, the couples couldn't have a second child with a son in urban areas under the one-child policy. After the implementation of the two-child policy, women with strong desire to have more babies would seize the opportunity to give a second birth in a short period, which would result in a sudden hike in the number of births and an ensuing increase in period fertility rates. The study defines the additional second births as cumulative effect on second births, which is resulting from historically cumulative influence of the one-child policy and mainly concentrated on second births. With the parameter, this study provides an approach to measure the restrictive influence of the one-child policy on women's second births, which is rarely understood in previous

studies. The cohort fertility pattern of the first group of women would witness significant changes due to this effect on women's fertility behaviours. Assuming one cohort of women were 30 years old in 2016, who were born in 1986, they experienced the cohort fertility pattern described by the dotted line before 30 and would present a new cohort pattern shown in the solid line (Figure 2.3). All cohorts of women entering childbearing ages before the implementation of the two-child policy in 2016 would potentially meet the sudden increase in the number of second births, consequently leading to a temporary rising in period fertility rates. In addition, the relaxed fertility policy allows all couples to have two children, which in fact greatly expands the size of reproductive population in second births. Women who didn't show strong desire to have two children would probably give a second birth due to Bandwagon effect, which increases fertility rates as well. For the second group of women, who step into reproductive ages after the implementation of the two-child policy, they would experience a significantly different cohort fertility pattern from the older generation. The fertility rates of second births would be higher than that under the one-child policy due to the additional second births resulting from the relaxed policy and expanded reproductive population. This group of women would never experience the one-child policy, which indicates the absence of cumulative effect on second births in their fertility behaviours under the two-child policy.

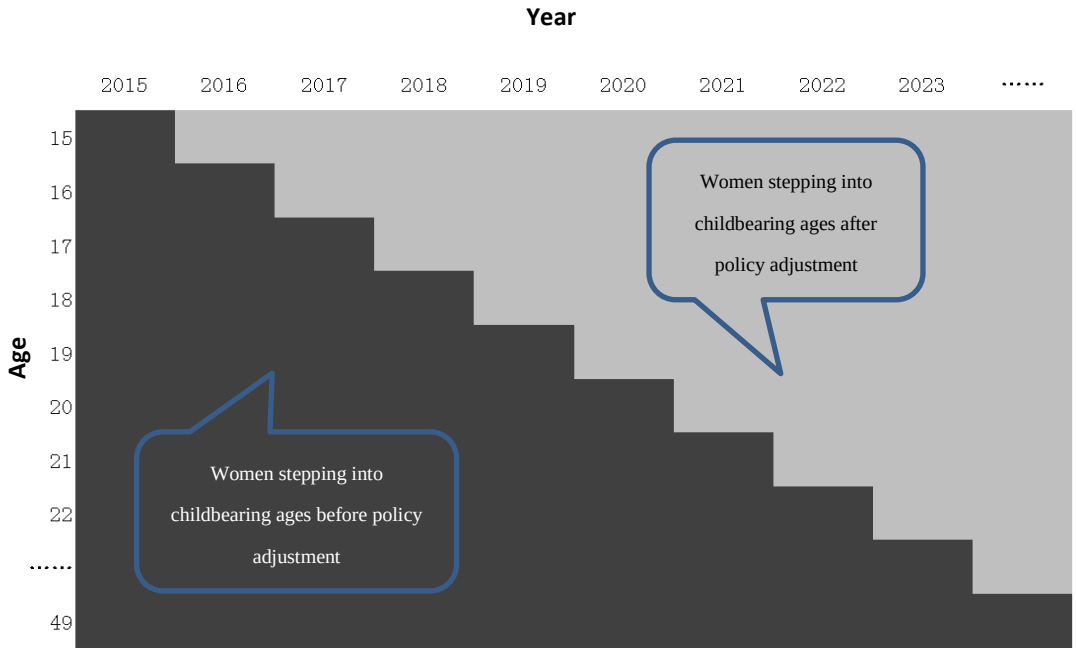

Figure 2. 2 Diagram of two groups women affected by the two-child policy

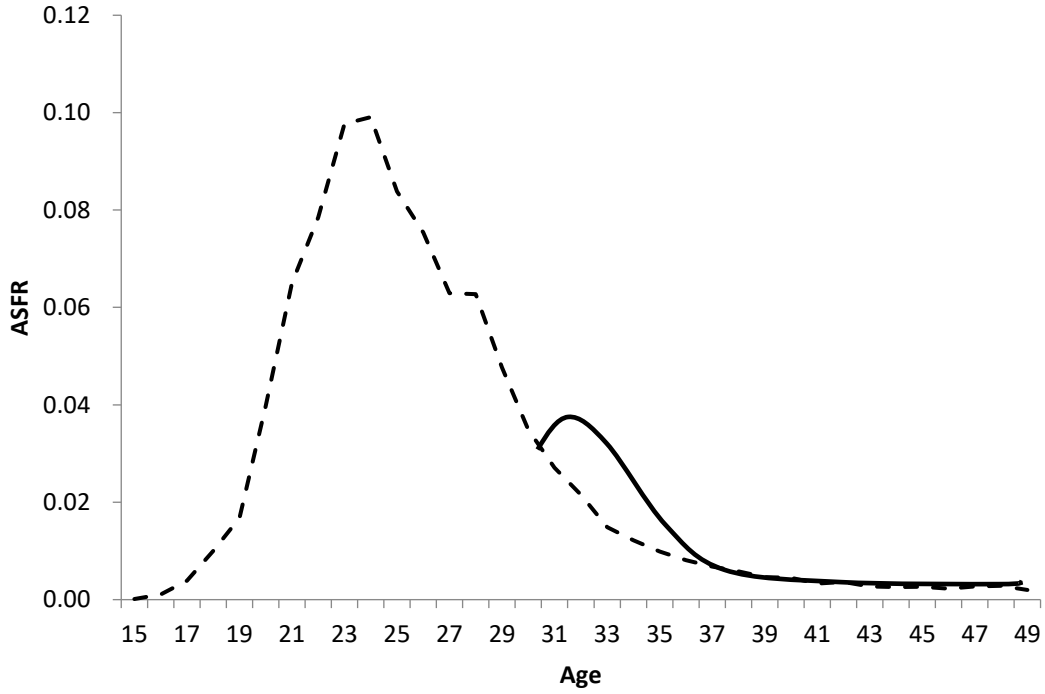

Figure 2. 3 Diagram of effects of the two-child policy on fertility rates

2.3 Future fertility regimes: Simulation method and parameters

Previous studies on the topic provide an inadequate understanding of the effects of the two-child policy on fertility rates in China, which are based on analysis of simple assumptions with fertility rates under the two-child policy or aggregated fertility desire from individual survey data organized under the one-child policy (Feng and Zhang, 2002; Zheng, 2004; Qiao and Ren, 2006; Ma and Hou, 2008). In this context, this study explores the influence mechanism and develops a simulation model for the analysis of changing fertility rates under the two-child policy in China, which is of importance in providing a better understanding of the profound implications of the fertility policy in the country. As discussed, China's fertility policy is designed to control births from the perspective of cohorts, which enhances the difficulty in analysing period fertility rates under sudden policy adjustments. To overcome the issue, this study separately discusses two mechanisms, through which the two-child policy affects women's fertility rates in China, and builds two corresponding equations for the simulations.

After the implementation of the two-child policy, some Chinese women in childbearing ages would change their fertility behaviours by giving more births, which would be closely related to women's fertility history, fertility desire, and other individual characteristics, such as age and marital status. These changes in fertility behaviours of women in different cohorts, when combined, would lead to an increase in period fertility rates under the two-child policy. This study builds a simulation model to measure Chinese women's fertility rates under the two-child policy, which aims to examine the effect of the new policy on Total Fertility Rate (TFR) in China. The data used in this study come from population censuses and 1% population sample survey published by the National Bureau of Statistics in China, specifically including the population censuses in 1982, 1990, 2000 and 2010, and 1% population sample survey in 1987,

1995 and 2005. These specialized data in demography provides detailed information of fertility, including age-specific fertility rates, parity-specific fertility rates. Using the interpolation method, the study estimates the age-specific fertility rates for each parity during 1982-2012 in China, which could be adopted as measurements of the fertility history of women in each cohort.

The two-child policy makes significantly different effects on the fertility rates of the two groups of women, who are defined based on the time when they enter childbearing ages. Hence, this study treats these two groups of women separately in the simulation process with two models. The first group of women entering childbearing ages before the implementation of the two-child policy spent part of their reproductive ages under the one-child policy, which were captured in their fertility history. After the first births allowed by the one-child policy, there still has a high proportion of women who would like to have a second child, about 50-60% (Yang, 2008; Hou et al., 2014; Jin, 2014). After the implementation of the two-child policy, these women would seize the chance and rush into second births, which are restricted by the administrative and economic punishment under the one-child policy, leading to a sudden hike in the number of annual births. To examine the fertility rates of this group of women under the two-child policy, the study builds the following model:

$$F_i = F_i^1 + F_i^2 + F_i^3 + X \cdot F_{i-1}^1 \cdot T_t \cdot P_i^2 + \sum_{j=15}^{k} \left(F_j^1 - F_j^2\right) \cdot P_i^2 \cdot T_t \qquad 3(1)$$

Notes: F_i denotes fertility rates of women aged i; F_i^1 denotes fertility rates for first births of women aged i; F_i^2 denotes fertility rates for second births of women aged i; F_i^3 denotes fertility rates for third births and above of women aged i. X denotes the influence coefficient of the two-child policy on second births. T denotes fertility timing of second birth. P_i^2 denotes fertility desire of women aged i. i denotes women's age, with values from 15 to 49; t is the number of years after the implementation of the two-child policy, with values between 1 and 10; and k denotes women's age in 2016 when the two-child policy was implemented.

The second group of women, who step into childbearing ages after the implementation of the two-child policy, would experience significantly different cohort fertility patterns from the older generations. These women would never experience the one-child policy, which implies that their fertility behaviours would not be affected by the cumulative effect on second births resulting from the strict one-child policy. It therefore should be noted that the effects of the two-child policy on these women is due to the relaxed policy and ensuing expanded reproductive population in second births. The study develops the model below to investigate the fertility rates of these women:

$$F_i = F_i^1 + F_i^2 + F_i^3 + X \cdot F_{i-1}^1 \cdot T_t \cdot P_i^2 \quad 3(2)$$

Notes: F_i denotes fertility rates of women aged i; F_i^1 denotes fertility rates for first births of women aged i; F_i^2 denotes fertility rates for second births of women aged i; F_i^3 denotes fertility rates for third births and above of women aged i. X denotes the influence coefficient of the two-child policy on second births. T denotes fertility timing of second birth. P_i^2 denotes fertility desire of women aged i. i denotes women's age, with values from 15 to 49; t is the number of years after the implementation of the two-child policy, with values between 1 and 10.

Table 2.1 specifies the detailed simulation process for further reference, taking one cohort of the first group of women as an example. In addition, this study next provides the detailed information of definitions and measurements of each parameter for a better understanding of the simulation model.

Table 2. 1 Detailed fertility simulations process under two-child policy

Year (Y)	Age (i)	Fertility Rate (F)
2015	i	$F_i^1 + F_i^3 + F_i^2$
2016	i+1	$F_{i+1}^1 + F_{i+1}^3 + F_{i+1}^2 + 0$
2017	i+2	$F_{i+2}^1 + F_{i+2}^2 + F_{i+2}^3 + X * F_{i+1}^1 * T^1 + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+2}^2 * T^1$
2018	i+3	$F_{i+3}^1 + F_{i+3}^2 + F_{i+3}^3 + X * (F_{i+1}^1 * T^2 + F_{i+2}^1 * T^1) + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+3}^2 * T^2$
2019	i+4	$F_{i+4}^1 + F_{i+4}^2 + F_{i+4}^3 + X * (F_{i+1}^1 * T^3 + F_{i+2}^1 * T^2 + F_{i+3}^1 * T^1) + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+4}^2 * T^3$
2020	i+5	$F_{i+5}^1 + F_{i+5}^2 + F_{i+5}^3 + X * (F_{i+1}^1 * T^4 + F_{i+2}^1 * T^3 + F_{i+3}^1 * T^2 + F_{i+4}^1 * T^1) + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+5}^2 * T^4$
2021	i+6	$F_{i+6}^1 + F_{i+6}^2 + F_{i+6}^3 + X * (F_{i+1}^1 * T^5 + F_{i+2}^1 * T^4 + F_{i+3}^1 * T^3 + F_{i+4}^1 * T^2 + F_{i+5}^1 * T^1) + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+6}^2 * T^5$
……		
2026	i+11	$F_{i+11}^1 + F_{i+11}^2 + F_{i+11}^3 + X * (F_{i+1}^1 * T^{10} + F_{i+2}^1 * T^9 + F_{i+3}^1 * T^8 + F_{i+4}^1 * T^7 + \ldots\ldots + F_{i+10}^1 * T^1) + \sum_{j=15}^{k} (F_j^1 - F_j^2) * P_{i+11}^2 * T^{10}$
2027	i+12	$F_{i+12}^1 + F_{i+12}^2 + F_{i+12}^3 + X * (F_{i+2}^1 * T^{10} + F_{i+3}^1 * T^9 + F_{i+4}^1 * T^8 + F_{i+5}^1 * T^7 + \ldots\ldots + F_{i+11}^1 * T^1)$
.....		

Notes: F_i denotes fertility rates of women aged i; F_i^1 denotes fertility rates for first births of women aged i; F_i^2 denotes fertility rates for second births of women aged i; F_i^3 denotes fertility rates for third births and above of women aged i. X denotes the influence coefficient of the two-child policy on second births. T denotes fertility timing of second birth. P_i^2 denotes fertility desire of women aged i. i denotes women's age, with values from 15 to 49; t is the number of years after the implementation of the two-child policy, with values between 1 and 10; and k denotes women's age in 2016 when the two-child policy was implemented.

2.3.1 Age-specific fertility rates (F)

The parameter F adopted in the model is used to measure women's age-specific fertility rates. Specifically, F_i^n $(n = 1, 2, 3)$ denotes the n^{th} parity fertility rates of women aged i; the sum of

F_i^1, F_i^2 and F_i^3 is the age-specific fertility rate of women aged i. The model assumes that the two-child policy has no influence on women's third and above births, considering China's low fertility rates of third and above births (only 0.08 in 2010) (NBS, 2012). With this assumption, this study particularly focuses on the influence of the two-child policy on the second births, which would present a different pattern under the new policy. The second births under the two-child policy consist of three components: one is the same as second births under the one-child policy, the second component is additional births with an expanded size of reproductive population under a relaxed policy, and the last component is due to the cumulative effect on second births resulting from long-term implementation of the strict one-child policy.

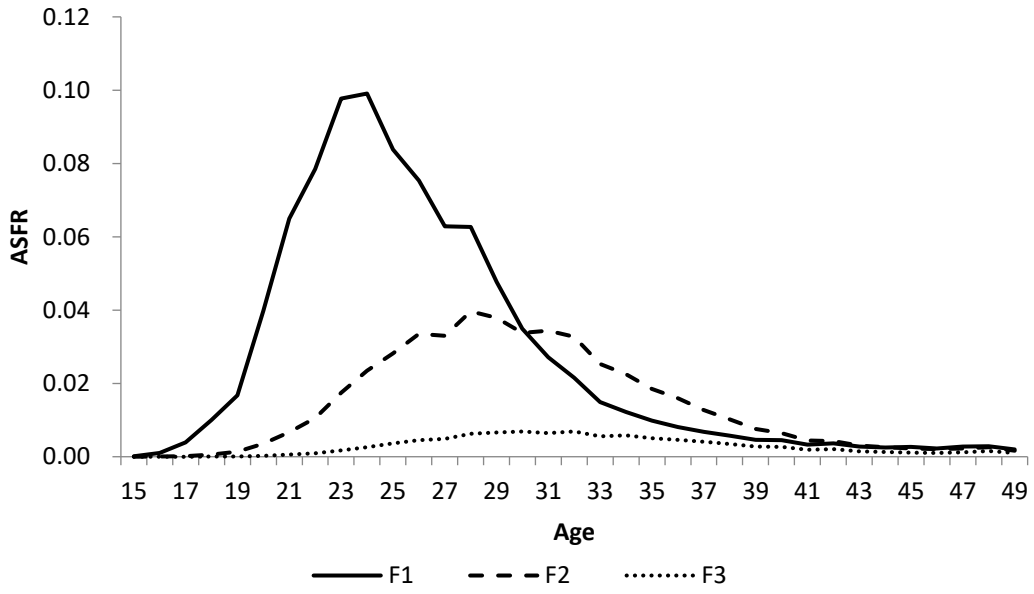

Figure 2. 4 Age-specific fertility rates in China, 2010

Notes: According to the original census data, the TFR in 2010 of China was only 1.18, however, previous studies show the true fertility level of China in 2010 at about 1.5 (Cui et al., 2013; Wang and Ge, 2013; Chen, 2014). This chapter adopts previous conclusions and proportionally adjusts the fertility rate to 1.5 using the fertility pattern from census data in 2010.

2.3.2 *Fertility desire of second births (P_i^2)*

The parameter P_i^2 in the model means the fertility desire of women aged i for second births, which is closely associated with fertility behaviours with a substantial effect on fertility rates (Yang, 2008; Chen and Jin, 2011). This parameter is defined as the proportion of women who have given birth to the first child and still want to have a second child. Previous studies have done a large amount of work on the topic of women's fertility desire in China, which significantly varies from 0.2 to 0.8, due to the various sources of data and definitions of fertility desire (Feng and Zhang, 2002; Zheng, 2004; Ma and Hou, 2008; Wang and Wang, 2013; Hou et al., 2014; Jin, 2014). At the end of twentieth century, the average ideal number of children was about 1.78 in China (Zheng, 2004), which almost kept unchanged till 2011 with 1.8, revealed by the Chine General Social Survey (Wang and Wang, 2013). One Survey organized by the Centre of Population and Development studies at Renmin University of China states that about 62% of women would like to have a second birth if the two-child policy would be implemented, which is specifically targeting on wives from *dandu* couples having one child (Jin, 2014). After the implementation of the selective two-child policy, an online survey covering tens of thousands of interviewees in 2013 shows that, about 59% of the Chinese people would like to give a second births (Zhai, 2013). In 2013, the National Health and Family Planning Commission of China conducted a survey, which is national representative covering 29 provinces in the country, and the results revealed that about 61% of couples who currently have only one child would like to have a second one (China Population Association, 2013). All these data from various sources suggest a rather high fertility desire of Chinese women.

To examine China's demographic future under different fertility regimes and improve the reliability and feasibility of the projection results, this study sets three scenarios of fertility

simulations with assumptions in fertility desire of women in second births. Previous studies conclude on different fertility desires to have a second child in China, which vary from 0.2 to 0.8. The newest survey with nationwide representative samples conducted by the National Health and Family Planning Commission in 2013 reveals about 60% of women would like to have two children. Consequently, the study sets the high scenario (0.6) with the fertility desire from this survey data, considering its timeliness and nationwide representative samples. Using this as reference, the study sets the other two scenarios to improve the reliability and feasibility of the results. Specifically, the high scenario sets fertility desire of women in second births at 0.6, meaning 60% of women would like to have two children under the two-child policy. The medium scenario sets fertility desire of women in second births at 0.45, and the low scenario sets fertility desire of women in second births at 0.3. In addition, the model includes age-specific fertility desire of women into simulation, which comes from the survey organized by the National Health and Family Planning Commission in 2013 (Figure 2.5). This survey is designed to target on married women in childbearing ages, which is nationwide representative with a sample of 63,417 individuals covering 29 provinces in the country.

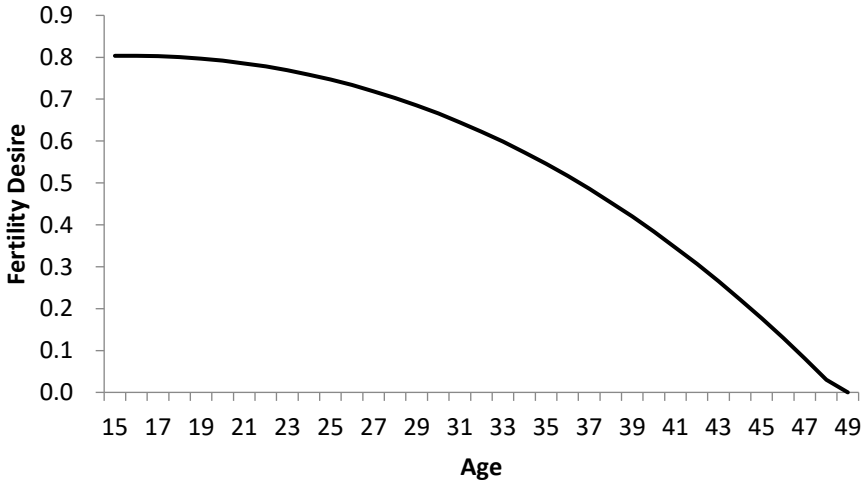

Figure 2. 5 Women's age-specific fertility desire in China, 2013

Sources: National Health and Family Planning Commission, 2013.

2.3.3 Timing distribution of second births (T)

The parameter T adopted in the model is to provide information of the timing distribution in second births, meaning the proportion of women who complete second births in t^{th} year after the implementation of the two-child policy. The new policy regulates all couples in the country with the fundamental right of having two children, without restriction on the timing of giving births. Assuming most women would give second births in the same year after the implementation of the two-child policy, the period fertility rate in that given year would present a sudden hike, resulting from the tempo effects (Bongaarts and Feeney, 1998). It therefore is full of significance to investigate the parameter of the timing distribution in second births in the analysis of simulating fertility rates under the two-child policy. This study adopts information from the specialized survey on the topic of fertility desire in China organized by the National Health and Family Planning Commission in 2013 (Figure 2.6). Almost 99% women would complete the second births within 10 years after the implementation of the two-child policy, and about 80% would complete the process within five years.

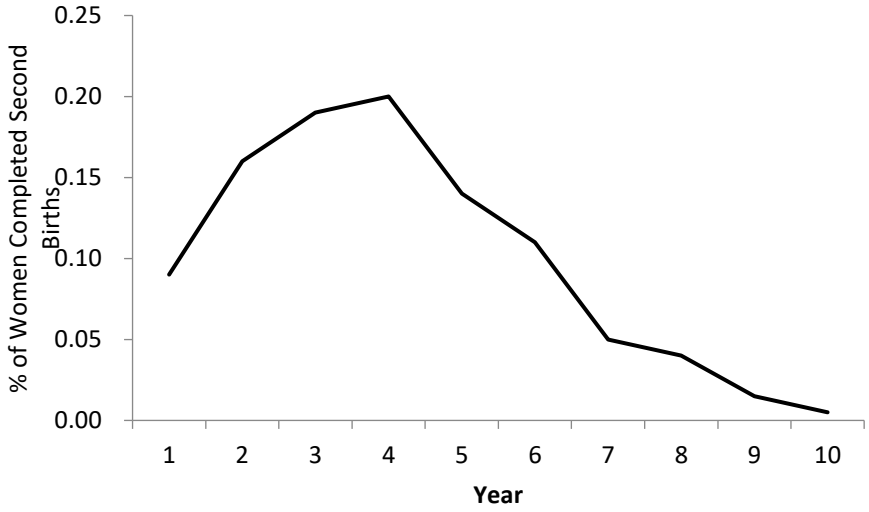

Figure 2. 6 Timing of second births

Sources: National Health and Family Planning Commission of the People's Republic of China, 2013

2.3.4 Influence coefficient of two-child policy on second births (X)

The parameter X is to define the influence coefficient of the two-child policy on second births, which examines the effect of the two-child policy on women's fertility rates due to the expanded size of reproductive population in second births. This coefficient is measured by women's capability of giving second births and fertility desire to have a second child. Women's capability of giving second births is defined as the gap between the total fertility rates of second births under the two-child policy (which is measured by the total fertility rates of first births under the one-child policy) and completed cohort fertility rates of second births, which indicates the maximum probability for women's second births after the implementation of the two-child policy. Fertility desire for second births is the proportion of women who would like to have a second child under the two-child policy. With these two components in measurement, the parameter X reflects the added effect of the two-child policy on women's second births.

$$\mathrm{X} = (\sum_{i=15}^{49} F_i^1 - \sum_{j=15}^{k} F_j^2) \cdot P^2$$

Notes: X denotes the influence coefficient of the two-child policy on second births. F_i^1 denotes the age-specific fertility rates of first births; F_j^2 denotes the age-specific fertility rate of second births. P^2 denotes the aggregated fertility desire of women in second births. k denotes women's age in 2016 when the two-child policy was implemented.

2.3.5 Cumulative effect of second births

The cumulative effect on second births in the model is adopted to investigate the historical restriction influence of the one-child policy on women's fertility rates. Under the one-child policy, some women with an intensive desire to have more babies were not allowed by the rigid regulations. After the implementation of the two-child policy, they would seize the chance to

realize the long-term restricted desire by rushing into second births, leading to a sudden hike in the number of annual births. This study defines the influence as the cumulative effect on second births coming from the strict one-child policy in the country. In the model, the parameter is measured as below:

$$C = \sum_{j=15}^{k} \left(F_j^1 - F_j^2\right) \cdot P_i^2$$

Notes: C denotes the cumulative effect on second births. F_j^1 denotes fertility rates of first births at age j; F_j^2 denotes fertility rates of second births at age j. P_i^2 denotes fertility desire of women aged i. k denotes women's age in 2016 when the two-child policy was implemented.

2.4 Demographic future of China under different fertility regimes

China is experiencing a significant demographic turning point due to the changes in its fertility policy (Chen, 2008). The decades-long one-child policy has made fundamental and profound impacts on Chinese society and economy. Before 2010, the Chinese population built a beneficial environment for socioeconomic development, with declining dependency ratio and rich labour force supply (Wang et al., 2004; Wang and Mason, 2005). However, after 2010, the negative effect of one-child policy acquired increasingly growing significance. The dependency ratio began to increase, the labour force reached a peak, and population ageing started to accelerate. Against this backdrop, China relaxed its fertility policy in 2016, which would undoubtedly affect its demographic future. The results from this study provide important evidence of Chinese population changes in the next four decades, including Total Fertility Rate, annual births, population size and age structure, labour force supply, and population ageing. In addition, the results are distinguished by three fertility scenarios.

2.4.1 Total fertility rate and annual births in China, 2016-2050

The most important result of this simulation is to project TFR for the next four decades, which determines the shape of China's demographic landscape in the future. The results are presented in Figure 2.7. First, China's TFR under two-child policy is largely affected by women's fertility desire of second births. In the high scenario, China's TFR would rise sharply after the implementation of two-child policy, with the peak value at 2.44 in 2020, and then present a rapid decline to lower than 1.75 in 2026. In the low scenario, with fertility desire of 0.3, the peak value of TFR in China would be 1.97, lower than that in high scenario by almost 0.5. The findings suggest the importance of women's fertility desire, which requires the government's concern in related policy-making and demographic practice. Second, the implementation of two-child policy will significantly increase China's fertility rate due to releasing of the cumulative effect of second births and enlargement of the size of policy targeted population, but the increase is temporary and then the fertility rates would present a visible decrease. The TFR projections also suggest that two-child policy is only an orientation of women's fertility behaviours, which regulates the maximum number of children women can give birth to over their lifetime without necessarily resulting in TFR of two. Because of women's biological fertility capability, fertility desire and economic costs for raising children, the real fertility rates would finally keep at level lower than two (fertility rates of third and above births are rather low in China, less than 0.1, unable to fill the gap).

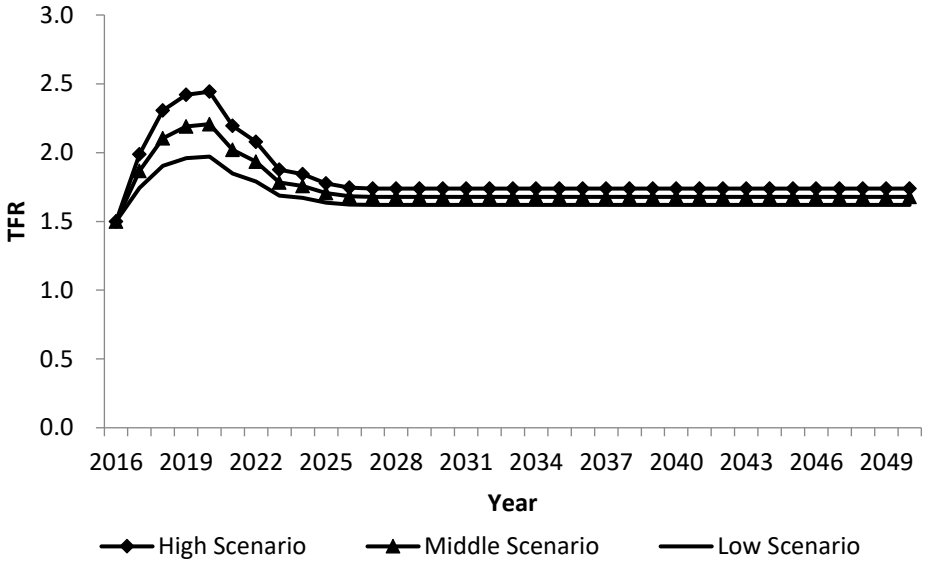

Figure 2. 7 Total fertility rate in China, 2016–2050

Based on estimations of TFR with the simulation models, this study uses cohort-component method to project China's demographic future under two-child policy, one of which is annual births in next 4 decades. Fertility policy adjustments directly affect China's TFR, which subsequently bring changes in annual births. After implementing two-child policy in 2016, China would present increasing annual births, from 15 million in 2016 to the peak value of 23 million in 2019 under high scenario (Figure 2.8). These figures show that relaxing fertility policy would significantly increase China's annual births, by about 8 million in first four years under high scenario and 3.7 million under low scenario. The findings provide evidence of the significant impact of two-child policy on China's population. As TFR changes under two-child policy, the short-term increase in annual births would sharply decrease after 2019, continuously to around 11 million at 2034. Then the annual births would slightly increase due to the large number of baby girls born around 2019 stepping into childbearing ages.

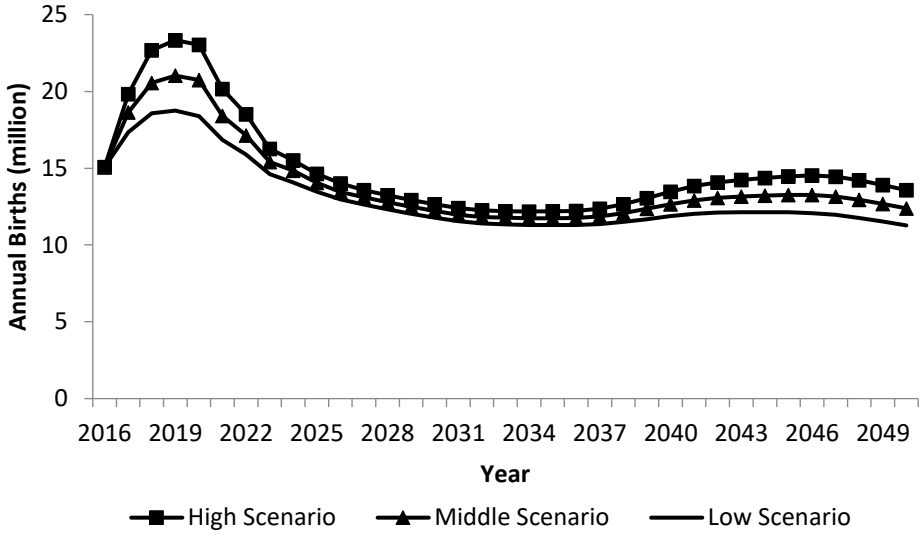

Figure 2. 8 Annual births in China, 2016–2050

The projection results of TFR and annual births adequately suggest positive effect of two-child policy on China's fertility rates, which indicate both challenges and opportunities for Chinese government. The growing annual births means increasing demands for maternal and infants' health care and ensuing shortages of related sources, such as kindergartens. In 2014, public expenditures for education and health care in China were 2,304.2 billion yuan and 1,017.7 billion yuan respectively, accounting for 15.2% and 6.7% of state financial expenditures (NBS, 2015). The growing new-born babies would further increase public expenditures for national and local governments. On the other hand, the growing births after implementing two-child policy means additional labour force supply in the future, which would benefit China's economy. The governments should be well prepared for the challenges caused by temporary increasing in annual births and fertility rates.

2.4.2 Size of Total population of China, 2016-2050

As the most populous country in the world, China's population size always catches attention and concern of the governments and the public. This study also investigates effects of two-child

policy on China's total population size, which is one of the main concerns in policy adjustments studies.

Table 2. 2 Size of total population in China, 2016–2050 (million)

Year	High Scenario	Medium Scenario	Low Scenario	One-child Policy
2016	1,378	1,378	1,378	1,378
2017	1,387	1,386	1,385	1,382
2018	1,399	1,396	1,393	1,386
2019	1,412	1,406	1,401	1,390
2020	1,424	1,416	1,408	1,393
2021	1,432	1,423	1,414	1,395
2022	1,439	1,429	1,418	1,397
2023	1,444	1,432	1,421	1,398
2024	1,448	1,435	1,423	1,398
2025	1,450	1,437	1,425	1,398
2026	1,452	1,438	1,425	1,397
2027	1,453	1,439	1,425	1,396
2028	1,453	1,438	1,424	1,394
2029	1,452	1,437	1,423	1,391
2030	1,451	1,436	1,421	1,387
2031	1,449	1,434	1,418	1,383
2032	1,447	1,431	1,415	1,379
2033	1,444	1,428	1,411	1,374
2034	1,441	1,424	1,407	1,368
2035	1,437	1,420	1,403	1,362
2036	1,434	1,416	1,398	1,356
2037	1,430	1,411	1,393	1,349
2038	1,426	1,407	1,388	1,342
2039	1,422	1,402	1,383	1,335
2040	1,418	1,398	1,378	1,328
2041	1,414	1,393	1,372	1,320
2042	1,411	1,388	1,367	1,312
2043	1,407	1,384	1,361	1,304
2044	1,403	1,379	1,355	1,295
2045	1,399	1,373	1,348	1,286
2046	1,395	1,368	1,342	1,276
2047	1,390	1,362	1,335	1,266
2048	1,385	1,355	1,327	1,255
2049	1,379	1,348	1,319	1,244
2050	1,373	1,341	1,310	1,233

Chinese population has kept growing for more than half century since 1950s, from 542 million in 1949 to 1,375 million in 2015 (NBS, 2016). After implementing two-child policy, China's population would keep rising for the next decade, up to 1,453 million in 2028 under high scenario and 1,425 million in 2026 under low scenario. (Table 2.2). However, relaxing fertility policy couldn't completely change China's demographic future. Chinese population would step into decreasing stages from the late 2030s, losing its first place in population size around the world. In 2050, Chinese population size would decline to 1,373 million under high scenario and 1,310 million under low scenario, even lower than that in 2015. Comparing with keeping one-child policy, implementing two-child policy significantly increases China's population size by around 100 million.

2.4.3 Population age structure changes in China, 2016-2050

In addition to size of total population, the Chinese population age structure present drastic changes as well under two-child policy in the future. The sex-age-specific pyramids of China in 2020, 2030 and 2040 under high scenario and one-child policy are presented in figures below, in which the left ones are under high scenario of two-child policy and the others are under one-child policy. As projected, the number of annual births in China will sharply increase after implementing two-child policy in a short term, leading to the distinct expansion at the bottom of population pyramid in 2020 and consequently postponing the ageing process to some extent. After 2030, these cohorts will gradually enter labour force market and increase labour force supply for China. However, at the same time the country will face an accelerated ageing process due to the large number of cohorts born around 1970s becoming old.

The right three figures show China's population age structure if the county were still under one-child policy in 2020, 2030 and 2040. Comparing with those under two-child policy, if

China kept its one-child policy, it would have a much older population in the future. These six pyramids figuratively describe the differences of China's demographic futures under two-child policy and one-child policy, which support the idea that two-child policy could slow down China's ageing process to some degree by increasing the number of annual births; however, it cannot stop the process.

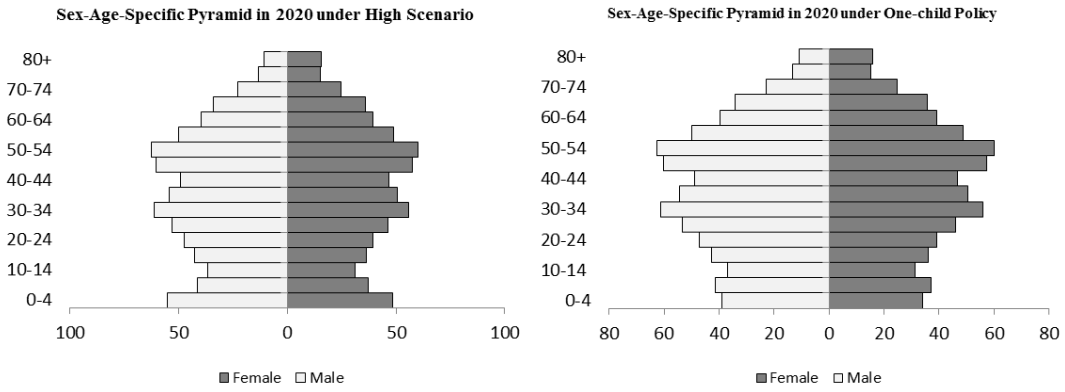

Figure 2. 9 Population pyramids in China, 2020

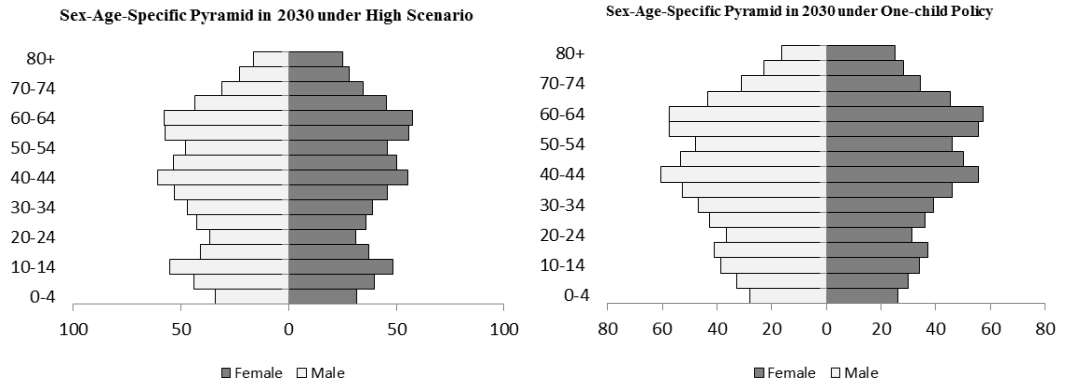

Figure 2. 10 Population pyramids in China, 2030

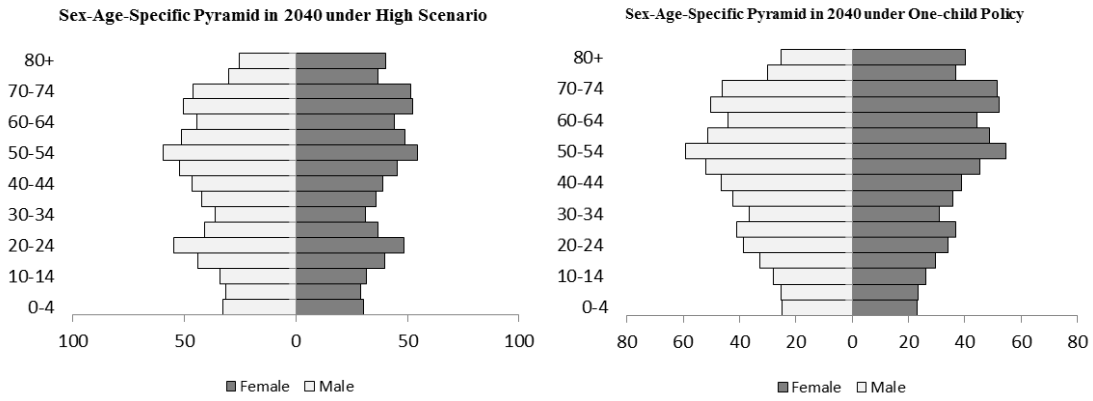

Figure 2. 11 Population pyramids in China, 2040

2.4.4 Labour force supply in China, 2016-2050

Since 1980s, China has benefited much from its rich and cheap labour force, resulting in an increasingly growing economy, which is generally defined as the first demographic dividend (Wang et al., 2004). However, China is facing a quite different demographic situation with a forthcoming or already arrived Lewis turning point, which implies a vanishing demographic dividend (Wang, 2005; Cai, 2010). In fact, working-age population aged 15-64 in China reached the peak value currently and afterwards began a decline (NBS, 2016). At the same time, the Chinese government relaxed its fertility policy, aiming to deal with its demographic problems. This study investigates changes of labour force supply under two-child policy in next four decades in China using population projections.

China's labour force will present a long-term decline in next four decades, although two-child policy was implemented all around the country in 2016 (Table 2.3). Under high scenario, the working-age population in China will decrease to less than 1,000 million in 2021, and further decline to less than 900 million in 2040. In 2050, size of working-age population in China would be 821 million under high scenario and 786 million under low scenario. Due to increasing births after implementing two-child policy, these cohorts would gradually enter labour force market after 2030, leading to a slower decreasing in labour force supply. In 2050, the size of working-age population under high scenario with two-child policy would be around 75 million more than that under one-child policy, which supports the positive effect of two-child policy on labour force supply in the future. Meanwhile, expanded cohorts caused by two-child policy could increase the proportion of young working-age population after 2030, resulting in a younger labour force. The average age of labour force under high scenario would be 0.6 years younger than that under low scenario in 2050.

Table 2. 3 Working-age population in China, 2016–2050 (million)

Year	High Scenario	Medium Scenario	Low Scenario	One-child Policy
2016	1,009	1,009	1,009	1,009
2017	1,008	1,008	1,008	1,008
2018	1,006	1,006	1,006	1,006
2019	1,004	1,004	1,004	1,004
2020	1,001	1,001	1,001	1,001
2021	997	997	997	997
2022	993	993	993	993
2023	989	989	989	989
2024	984	984	984	984
2025	978	978	978	978
2026	973	973	973	973
2027	968	968	968	968
2028	963	963	963	963
2029	958	958	958	958
2030	951	951	951	951
2031	943	943	943	943
2032	938	937	936	934
2033	935	932	929	923
2034	933	927	922	911
2035	930	922	914	899
2036	925	915	906	887
2037	919	908	897	876
2038	911	899	888	865
2039	903	891	879	854
2040	896	883	870	844
2041	889	875	862	835
2042	882	868	855	826
2043	877	862	848	818
2044	871	856	842	810
2045	865	850	835	801
2046	858	842	827	792
2047	849	833	818	782
2048	841	824	808	770
2049	831	814	798	758
2050	821	803	786	746

The projection results of labour force supply in China show that the country will still have a large working-age population in next four decades. However, the growing wages

and ageing process in labour force will dramatically challenge the country's economy. In addition, when compared with developed countries, China is experiencing a low production rate and labour-intense economic growth pattern. Thus, implementing two-child policy made little effect on China's economic sustainability, except for positively affecting the size of labour force supply in the future. To boost the economy in the future, the government should focus on other key issues, such as income distribution, energy and resources pricing reform, industrial restructuring, and stimulation of domestic demands.

In addition to a decreasing labour force in next four decades, China will experience an increasing dependency ratio during the same period. In 2016, China's total dependency ratio is about 0.37, meaning one labour force needs to support 0.37 dependents (children aged 0–14 and the elderly aged 65 and above). In the next three decades, the dependency ratio in China will keep rising, up to 0.67 in 2050 under high scenario with two-child policy, almost twice that in 2016 (Figure 2.12). The increasing dependency ratio indicates a growing total dependency burden, which means the society will consume more to support young children and the elderly. For the state and local governments, increasing public expenditure are necessary on social security system, pension system and health care to guarantee the Chinese living. The increasing dependency ratio will negatively affect the social wealth and economic growth in China.

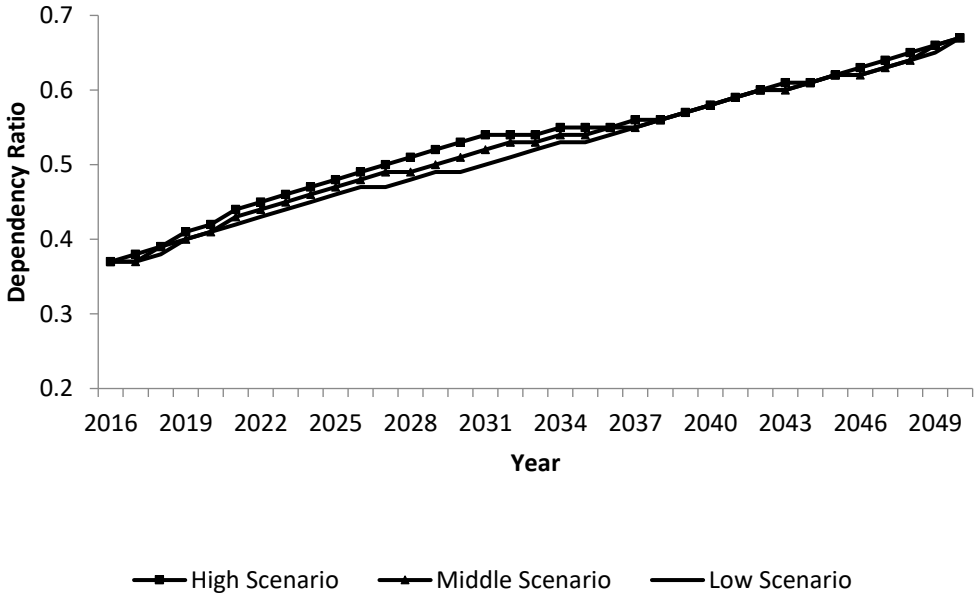

Figure 2. 12 Dependency ratios in China, 2016–2050

2.4.5 Population ageing in China, 2016-2050

China stepped into an ageing society at the turning of the twenty-first century, with the share of the elderly (aged 65 and above) of 7% and the size of 88 million (NBS, 2002). The newest statistics report published by NBS shows the proportion of the elderly increases to 10.5% in 2015, with the size of 144 million (NBS, 2016). Obviously, the Chinese population have undergone a rapid ageing process since it entered the stage. In next two decades, China will face an accelerating ageing process accompanied by large cohorts born around the 1970s becoming old, which is one of the issues two-child policy aims to solve. Some scholars argued that this new policy could relieve the ageing process by expanding young cohorts and decreasing the share of the elderly (Zhai et al, 2014). The projection results presented in Figure 2.13 show China's population ageing under high scenario with two-child policy in next four decades. In the future, the country will experience an increasingly ageing population, from 144 million in 2016 to 349 million in 2050, growing by about 1.5 times in 35 years. Meanwhile, the

share of the elderly will increase from 10.4% to 25.4% during this period. These figures suggest China's rapid population ageing and heavy dependency burden in the future.

In addition to large size and increasing proportions of the elderly, the old population in China is becoming older itself, which is shown by the age composition of the elderly (Figure 2.14). In the next 35 years, the proportion of the old elderly aged 80 and above would present a continuous increase from 16.2% in 2016 to 29% in 2050. On the other hand, the young elderly aged 65–69 would decline from 40% in 2016 to about 25% in 2050. The projections reveal that ageing is occurring in all age groups in China, including the labour force, the elderly and the total population. In addition, the growing old elderly means increasing demands for long-term care and medical care, which requires supports from households, the society and governments.

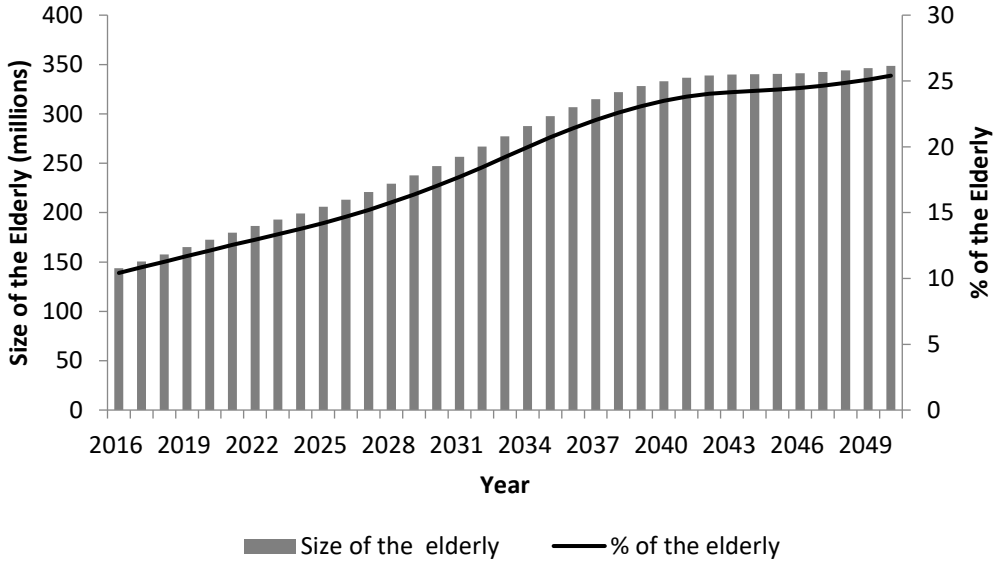

Figure 2. 13 Size and proportion of old population in China, 2016–2050

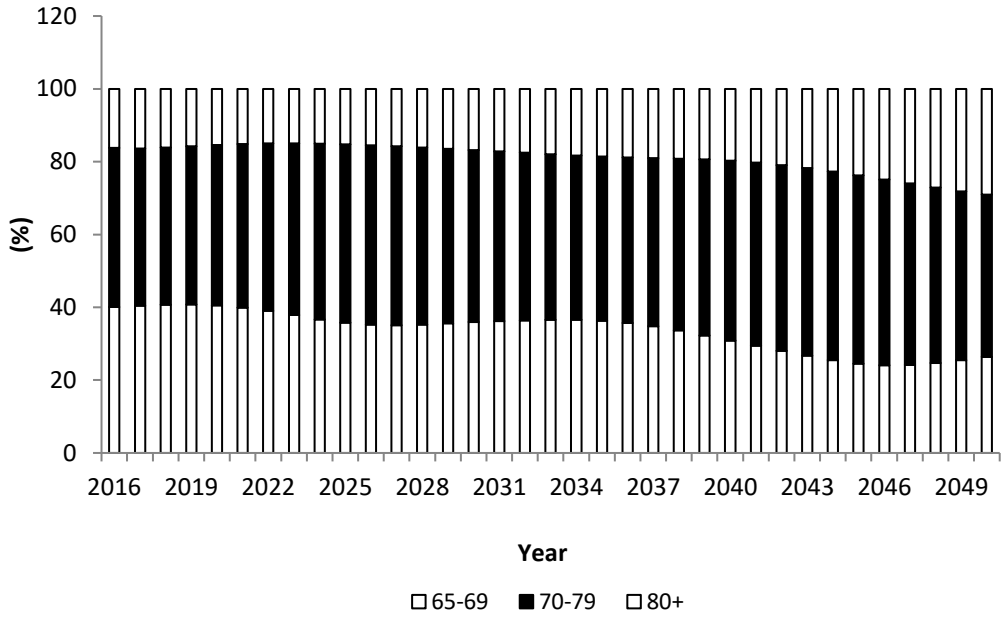

Figure 2. 14 Age composition of old population in China, 2016–2050

2.5 Conclusion and discussion

China implemented the two-child policy in 2016 after decades of debates and deliberations, and ended its ambitious but controversial one-child policy which started in the 1970s. One of the important demographic indicators, fertility rate under the two-child policy, has received intense attention and concerns from policy-makers, academic community and the general public (Li, 1997; Zeng, 2005, Mu, 2006; Zhai et al., 2014; Wang, 2016). However, previous studies tended to concentrate on general discussion and preliminary examinations about effects of the two-child policy on fertility rates using traditional methods, which is ineffective in analysis of sudden fertility adjustments, and comprehensive and quantifiable measurement of women's fertility rates under the two-child policy has not been available (Guo, 2004; Qiao and Ren, 2006; Wang, 2015). To overcome the shortcomings of traditional methods and investigate the influences of the two-child policy on fertility rates, this study develops the improved simulation model, providing comprehensive results of women's fertility rates under the two-child policy,

taking women's fertility history, fertility desire, cumulative effect of second births and other factors into consideration. The analysis contributes to a better understanding of changes in fertility rates in China, by capturing the effects of sudden policy adjustments on women's fertility behaviours and patterns, an area that has not previously been adequately understood.

China's fertility policy regulates the number of children women could have over their lifetime, which is in fact the cohort fertility rates. However, TFR, a period indicator of fertility rates, makes more significance in population projections, population planning, and policy making. The study explores the mechanisms, through which the two-child policy affects women's fertility rates, and treats two groups of women separately in the simulation model. With two specific equations, this study simulates the age-specific fertility rates of women in each cohort under the two-child policy from the perspective of cohort, with estimations of additional births from the relaxed policy and historical cumulative effect of second births. It then estimates the period fertility rates (TFR) by summarising the age-specific fertility rates of each age group in one given year. This model provides an approach of estimating period fertility rates after a sudden policy adjustment in a country or region, where fertility policies are designed to regulate number of children women could have over their lifetime. This study fills a void in the field, contributing methodological significance in demographic research.

With the simulation results of TFR, this study examines the demographic future in China under the two-child policy. The results suggest that the two-child policy would bring a significant but temporary increase in fertility rates, with the peak value of 1.97 at 2020, due to cumulative effect on second births and enlarged reproductive population in second births. However, the two-child policy plays a trivial role in fertility rates in long run, especially with the large cohorts born around the 1970s withdrawing from childbearing ages. The increase in

fertility rates directly leads to a larger number of annual births in the short period after implementing the new policy, with a peak value of 18.8 million in 2019. Meanwhile, the Chinese population will keep rising until 2026 with a size of 1,425 million (low scenario), which is larger by 28 million than that under the one-child policy. In addition, the two-child policy would marginally affect the labour force supply and population ageing in next four decades. It particularly should be noted that China will undoubtedly face an inevitable ageing process, resulting from its long-term one-child policy and rapid demographic transition in the past.

This timely study investigates the impacts of the two-child policy on the demographic future in China, including fertility rates, population size and structure, labour force, and population ageing. With these projection results, this study provides comprehensive and detailed demographic statistics, which could contribute to the evaluation of the new policy, future population planning and fiscal expenditure, as well as to the formulation of social welfare provision in the future. The findings suggest that the two-child policy makes significant but limited effect on its labour force supply and population ageing in the next decades, with the largest cohorts of women born around the 1970s withdrawing from childbearing ages. Therefore, to further boost its economy, China should pay more attention on other aspects, including restructuring the economy, implementing institutional reforms, and improving the income distribution, instead of relying on the advantages of labour supply that it benefited in the past decades.

Chapter 3 China's Labour Force Supply and Population Ageing

3.1 Introduction

China experienced a rapid demographic transition process in the past three decades, which has resulted in drastic changes in its population composition, including a decline in the dependency ratio and low fertility rates, along with an increased size and share of working-age population (aged 15−64), and a growing proportion of elderly population. The main changes that have arisen due to the changing age structure of China's population include a decline in the share of children aged 0−14, along with the increasing proportion of labour force and that of the elderly in the total population. Specifically, the percentage of children aged 0−14 has been experiencing a long-term decline since the 1960s, from 73.0% in 1964 to 22.1% in 2011, following a temporary ten-year increase of 61.2% in 1953 (NBS, 2015). On the other hand, the proportion of working-age population in China experienced a short-term decline during 1953−1964, after which it gradually increased from 55.8% in 1964 to 74.5% in 2010 (NBS 2015). The growing working-age population has ensured a continued supply of labour force in the past three decades in China. The Chinese economy has benefitted greatly from its abundant and cheap labour force, which directly contributes about 10% to the contemporary GDP growth (Cai, 2014). However, as the share of the elderly (aged 65 and above) underwent similar changes, this places a burden on the economy. In 2000, those aged 65 and above comprised 7% of the total population, indicating that China has started to enter an ageing society (NBS, 2002). This trend has continued, whereby elderly comprised 8.9% of the total population in 2010 (Figure 3.1). In the decades that follow, China will confront a more rapid ageing process in its population, as the large cohorts born in the 1960s and 1970s enter the old ages while fertility rates remain low.

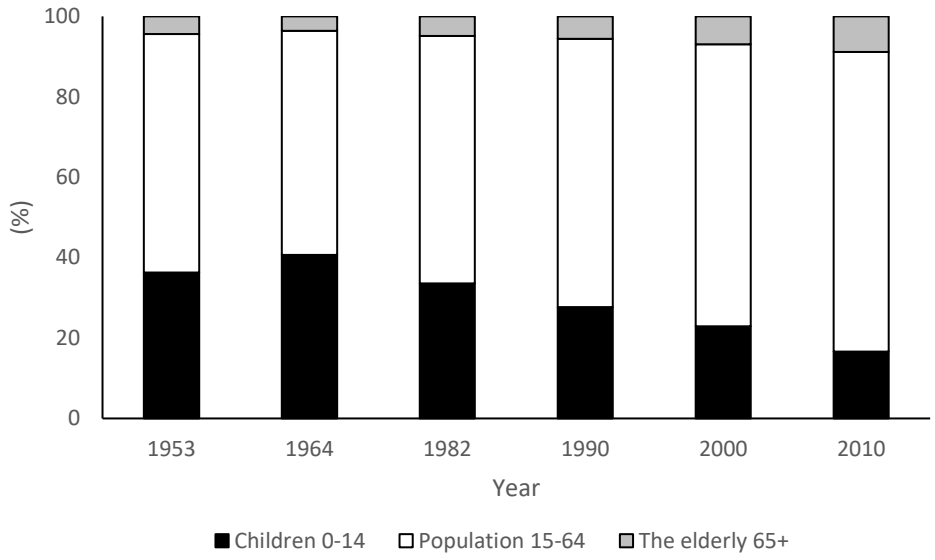

Figure 3. 1 China's population age structure changes in the census years

(1953, 1964, 1982, 1990, 2000, and 2010)

Sources: National Bureau of Statistics. 2016. China Statistical Yearbook 2015. Beijing: China Statistics Press

The size of working-age population in China has been increasing for more than sixty years since the 1950s. According to the 1953 population census data, 346 million individuals were of the working-age (NBS, 1985). In the following sixty years, the working-age population size gradually increased, reaching 1,006 million in 2013, which is equivalent to an annual growth rate of 1.75% (NBS, 2014). This corresponded to significant increases in the proportion of working-age population, from 59.3% in 1953 to 74.5% in 2010 (NBS, 2012). The growing size and share of the working-age population in the last six decades provided China with abundant and cheap labour force, which served as a beneficial demographic base for its economy and society (Wang and Mason, 2006; Cai, 2010; Wang and Yang, 2010). During 1980−2000, the declining dependency ratio contributed about 20-25% to the contemporary GDP growth (Wang et al. 2004; Cai and Wang, 2005; Bloom and Finlay, 2009). As a result, the country's economic growth was implicitly boosted by the abundant labour force and the declining dependency ratio,

which has had significant effects on labour-intensive industries and exports of low-cost products.

In addition to the working-age population in China increasing in size and proportion, the reallocation of labour force from rural to urban areas contributed to the economic growth in the country as well (Hu, 1998; Cai and Wang, 1999; Ding, 2001; Li and Li, 2005; Liu and Tian, 2005; Cai, 2010; Jia and Xin, 2010; Qi, 2014; Hao, 2016; Wu, 2016). Since the early 1990s, the size of labour force that transferred from agricultural to industrial sectors has continuously increased, from 87 million in 1990 to about 150 million in 2000, and further to 250 million in 2011, signifying a more rapid growth (MAC, 2009; NBS, 2011). The national reallocations of labour force, whereby workers migrate, in other word, float, from province to province and rural to urban areas as needed, have had significant positive effects on China's economic growth, and have contributed about 12% to the contemporary GDP growth during 1991−2011 (Qi, 2014). However, in recent years, both size and proportion of migrant workers in China stopped increasing rapidly, as indicated by the emergence of the Lewis turning point and the diminishing of demographic dividend in the country. In fact, with the exception of 2009, since 2003, the number of migrant workers gradually decreased (Cai, 2010). In addition, since the 1990s, the growth of working-age population slowed down in rural areas, indicating that the reliance on the large size of floating labour force cannot continue in the country. These demographic shifts will diminish the positive effect that the floating labour force has had on the Chinese economy (Wu, 2016), although it still contributes to the economic growth.

The most recent statistics report published by the National Bureau of Statistics in China reveals that the size and share of working-age population has peaked around 2013 (NBS, 2014), suggesting that the country will face a declining labour force supply in the future. In addition,

as the Chinese labour force is ageing, an increasing proportion of old workers (those aged 45 and above) will outnumber those aged 15−29. The median age of working-age population has also shown an increasing trend during the past two decades. All these changes in labour force supply would dramatically affect China's economy and society in the future. In 2016, the Chinese government implemented the two-child policy, aiming to address the country's demographic issues, including long-term low fertility rates, population ageing, and shortages in labour force supply. However, extensive knowledge of the size and proportion of labour force of China in the past cannot be used to predict its effects in the future, especially under the new fertility policy.

It is under this background that this study explores the challenges faced with the labour force supply in China, especially under the rapid population ageing process, including increasing labour force costs, low productivity and ageing in labour force. Furthermore, this chapter also examines the future labour force supply in China. In the study reported in this chapter, extensive analyses are conducted in order to project the size, proportion and age composition of the working-age population of China in the next four decades. In the projection process, the new fertility policy is taken into consideration, which timely investigates the influence of policy adjustments on China's labour force supply in the future and fills the gaps in previous researches without taking policy factors into consideration. In addition, to examine the impact of ageing on China's economy through labour force supply, the contribution of ageing on labour force participation rates and economic growth in the country is investigated using standardisation method and production function.

3.2 Current challenges of labour force supply in China

3.2.1 Ageing in labour force in China

The size of the labour force in China has been increasing for 60 years, from 346 million in 1953, up to the peak value of 1,006 million in 2013 (NBS, 1985; NBS, 2014). The size of working-age population began to decrease in 2014, and in fact the share of working-age population in total population of China has declined since 2011(NBS, 2012; NBS, 2015). These trends in working-age population suggest that China is losing the advantages associated with the abundance of labour force supply, which has thus far weakened the country's competitiveness in international trade. In the future, the country is likely to face a decrease in its labour force, implying the end of labour-intensive economic growth.

Age structure of labour force in China experienced significant changes during the past six decades (Figure 3.2). The proportion of young workers (those aged 15−29) in the working-age population increased for more than thirty years from the 1950s, exceeding 40% in the mid-1980s (NBS, 1985). During the same period, the proportion of older workers (aged 45−64) continued to decline. However, the situation became markedly different in the 1990s, when the share of old labour force increased, while that of the young workers declined (Chen, 2006; Zhai and Yang, 2011). Specifically, the proportion of workers aged 45−64 increased from 22.0% in 1990 to 37.7% in 2015, while the share of young labour force aged 15−29 declined from 47.0% to 31.2% (UN, 2015). The aging labour force is an issue, as old workers experience difficulties in adapting to occupational adjustments and changes caused by industrial restructuring and technical innovation. The ageing labour force in China might thus negatively affect productivity rates and human capital accumulation, owing to lower productivity rates (Yu, 1995). Yang and Lu (2006) estimated the productivity rates of China in the next four decades, pointing out that

the country's productivity rates would reach minimum around 2035, when the labour force will be the oldest.

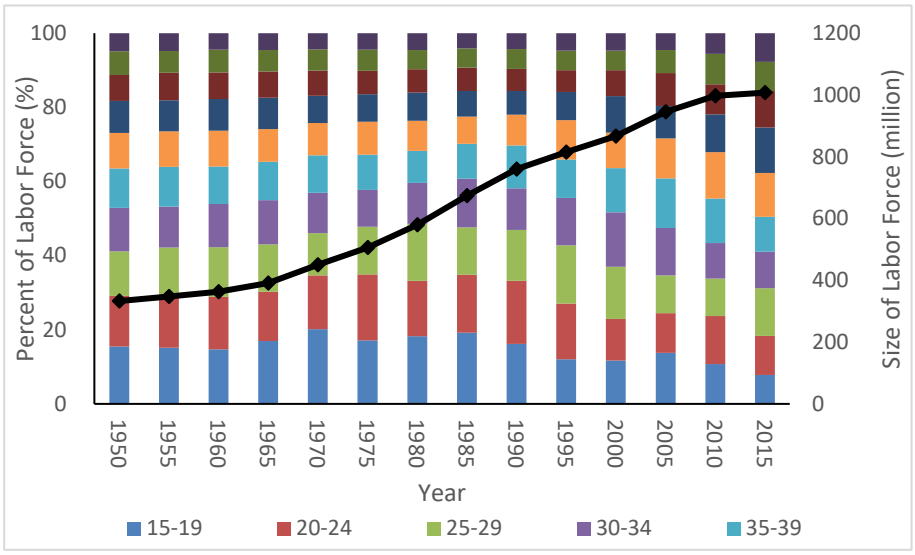

Figure 3. 2 Size and age composition of labour force in China, 1950-2015

Sources: United Nations, Department of Economic and Social Affairs, Population Division. 2015 World Population Prospects: The 2015 Revision.

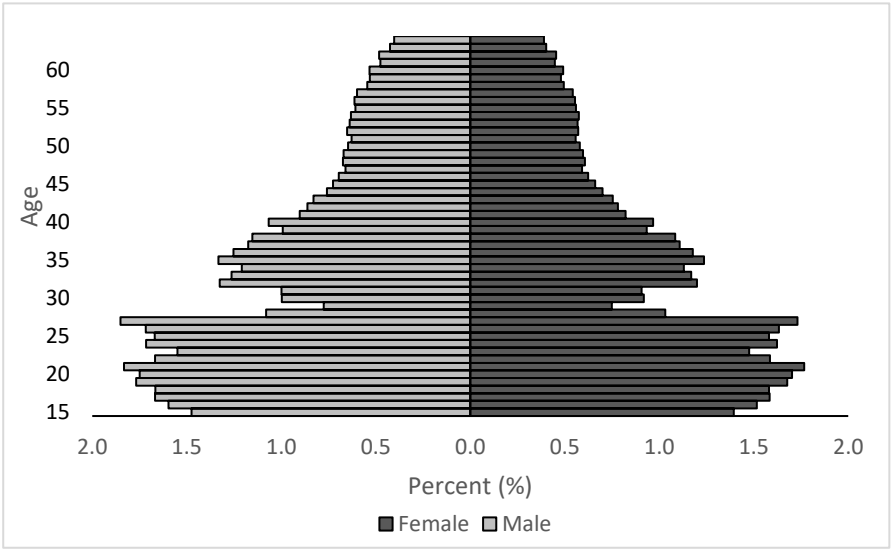

Figure 3. 3 Population pyramid of labour force in China, 1990

Sources: Population Census Office under the State Council, Department of Population Statistics at National Bureau of Statistics. 1992. Tabulation on the 1990 Population Census of the People's Republic of China. Beijing: China Statistics Press.

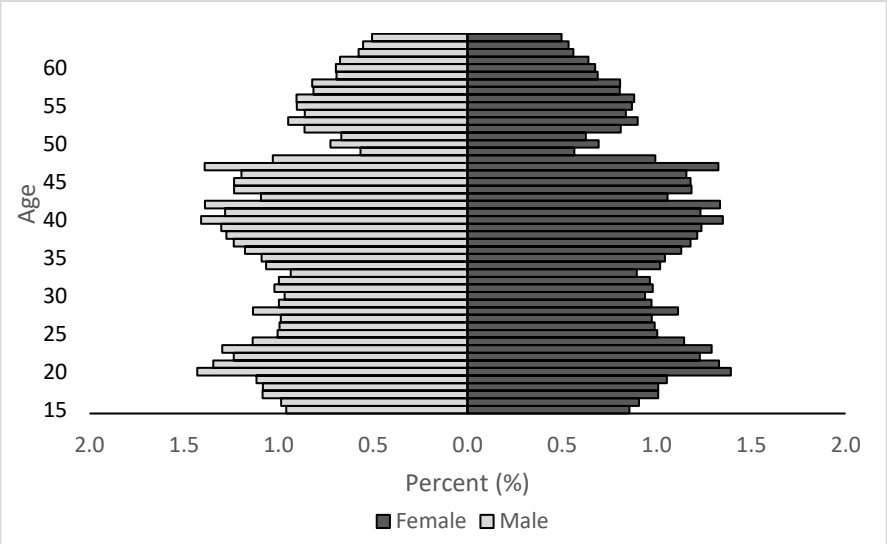

Figure 3. 4 Population pyramid of labour force in China, 2010

Sources: Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

The labour force pyramids for 1990 and 2010 are presented in Figure 3.3 and Figure 3.4, respectively, confirming the ageing trend in China's labour force from 1990 to 2010. In 1990, the labour force pyramid was approximately triangular in shape (Figure 3.3), while that pertaining to 2010 has a much narrower bottom and an expanded top (Figure 3.4). The comparisons reveal a significant decline in the proportion of young labour force in China from 1990 to 2010.

In addition, an increasing median age of labour force after 1990 also indicates an ageing labour force in China. More specifically, while the median age of working-age population in China showed a decline before 1980s, it started to increase in the 1990s, from 31.4 in 1990 to 39.7 in 2015 (UN, 2015). In the next three decades, the median age of labour force in China will further increase, reaching around 44 in 2040, indicating an accelerated ageing trend in the country's labour force (Figure 3.5). The labour force ageing would have detrimental effects on

China's productivity rates. It will also weaken the country's economic competitiveness and will threaten the sustainable economic growth, leading to unprecedented challenges to China's economy (Zhang, 2010).

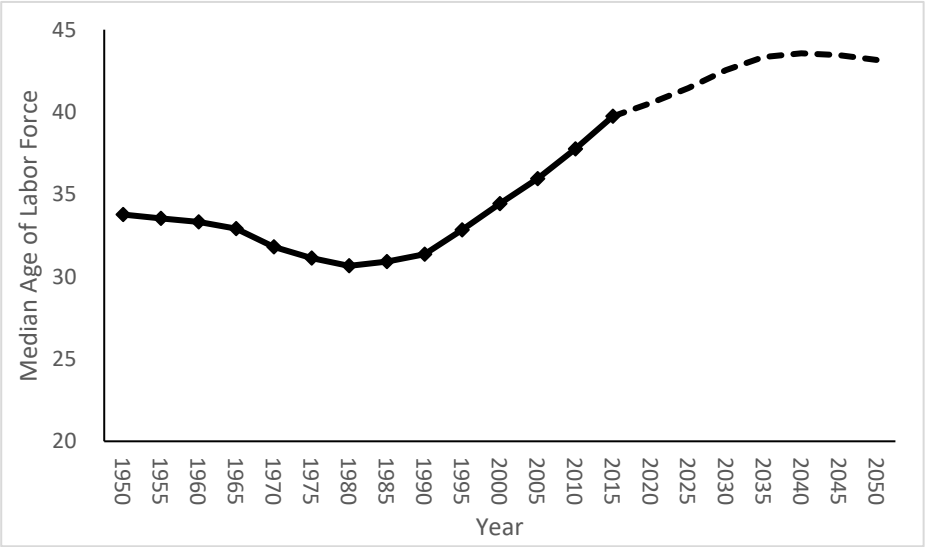

Figure 3. 5 Median age of labour force in China, 1950-2050

Sources: United Nations, Department of Economic and Social Affairs, Population Division. 2015. World Population Prospects: The 2015 Revision

3.2.2 Low productivity in China

Along with the gradual disappearance of advantages associated with large labour force size, China has faced other issues in recent years, one of which is the uncompetitive productivity rates in its economy. China's economic miracle that has characterised in the last three decades is mostly attributed to its economic and political reforms, large financial investments, and demographic dividend arising from abundant labour force supply. However, owing to the long-term implementation of the one-child policy, the size and proportion of working-age population in China has begun to decline recently, resulting in the vanishing of the demographic dividend.

These changing demographic conditions have exacerbated the productivity rates issue in China's economy, which are particularly apparent when compared to the developed countries. During the period from 1991 to 2014, the productivity rate in China was increasing continuously, from 2,900 USD to 21,600 USD (World Bank, 2016). This shift implies that China has made a great progress in improving its productivity rates in the last two decades. Nonetheless, productivity of employed population in China remains below that recorded in the developed countries (Figure 3.6). In 1991−2014, the productivity rates in China were significantly lower than in the United States, the European Union and Japan, as measured by the GDP per person employed (constant 2011 PPP thousand US dollars). In 2014, the productivity rate of Chinese workers was estimated at only 20% of that in the US, corresponding to about 67% of the world average (World Bank 2016). Although China's productivity rates have been increasing in the past several decades, they still lag behind those in the developed countries. The comparatively low productivity rates would weaken China's competitiveness in international trade, threatening its sustainable economic growth in the future.

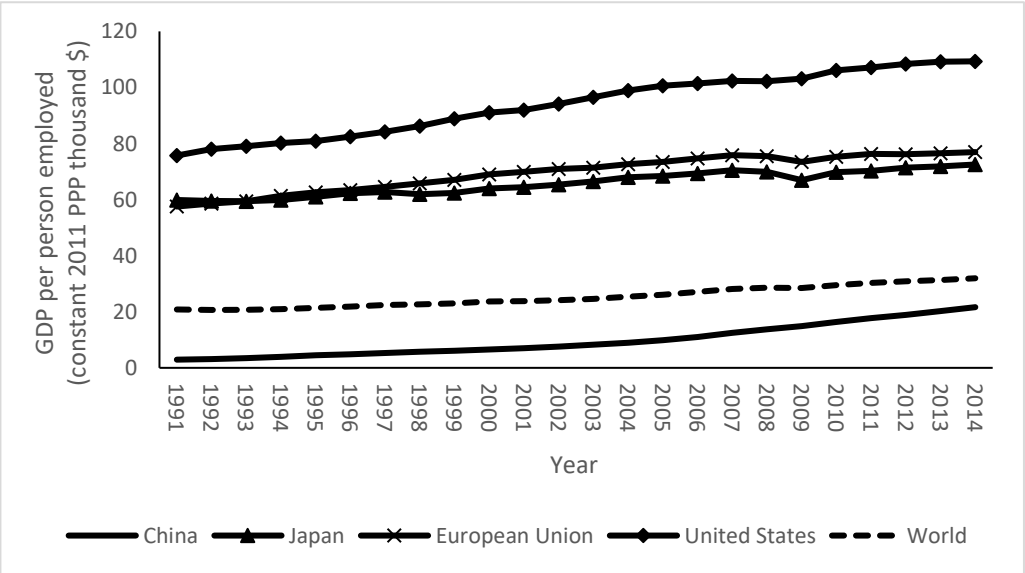

Figure 3. 6 Productivity in selected countries, 1991-2014

Sources: World Bank. 2016. http://data.worldbank.org/indicator/SL.GDP.PCAP.EM.KD?view=chart

The productivity rates in different economic sectors in China exhibit marked differences, despite general increases. In 2015, the greatest number of employed population was absorbed in the tertiary sector (catering, tourism, services, etc.), estimated at about 328.4 million, while 226.9 million and 219.2 million worked in the secondary sector (mining, construction, manufacturing, etc.) and the primary sector (agriculture, forestry, fishing, animal husbandry, etc.), respectively (NBS, 2016). Moreover, the secondary sector shows the highest productivity rate, estimated at 123,600 *yuan* per person employed, while the primary sector has the lowest productivity rate, about 27,800 *yuan* per person employed (NBS, 2016). The gaps in productivity rates among three sectors in China have been widening during the past decade. In the primary sector particularly, the low productivity rates of the agricultural labour make it difficult for these workers to gain employment in industrial sectors for efficient labour force reallocation.

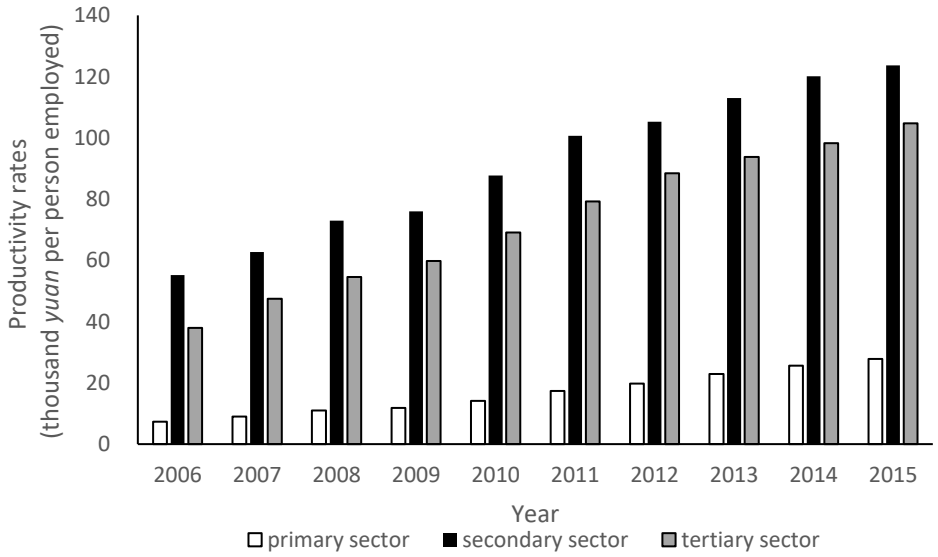

Figure 3. 7 China's productivity in three sectors, 2006-2015

Sources: National Bureau of Statistics. 2016. China Statistical Yearbook 2016. Beijing: China Statistics Press

3.2.3 Increasing wages and labour force cost

In 2010, China surpassed Japan to become the world's second largest economy behind the United States, owing to a spectacular growth during the preceding three decades (World Bank, 2011). China's great economic achievements are attributed to large financial investments, abundant labour force and economic reforms with related policy support. During this period, the low cost of labour force also played an important role in enhancing the country's economic competitiveness, attracting substantial foreign investments into China. Due to the abundant and cheap labour force, China transitioned from low-income into middle-income country characterised by an export-oriented development strategy based on capital-driven and labour-intensive industries, which are dependent on the abundance of cheap labour force. Currently, China is facing issues associated with rapidly ageing population, which will result in a marked decline in the labour force size and proportion, leading to the disappearance of the advantages stemming from plentiful supply of cheap labour force in the country.

In addition, available evidence indicates that the labour force cost in China is rapidly growing. The increasing worker wages will result in irreversible and inevitable vanishing of the first demographic dividend that the country has benefited from thus far. The average yearly wage of employed population in China during 1995−2015 is presented in Table 3.1. It indicates that, during the last two decades, the average wage of employed population in China increased by more than 10-fold, from 5,348 *yuan* in 1995 to 62,029 *yuan* in 2015 (Table 3.1). In real terms, the average wage increased by about 7.5 times in 1995−2015, excluding the effects of price index with CPI. The rapidly growing average wages in China indicate an increasing labour force cost that will have a profound adverse effect on the economy.

Table 3. 1Average wages of employed population in China, 1995-2015 (*yuan*)

Year	Average wage	Indices of average wage [1]	Indices of average real wage[2]
1995	5,348	118.9	101.8
1996	5,980	111.8	102.8
1997	6,444	107.8	104.5
1998	7,446	115.5	116.2
1999	8,319	111.7	113.2
2000	9,333	112.2	111.3
2001	10,834	116.1	115.3
2002	12,373	114.2	115.4
2003	13,969	112.9	111.9
2004	15,920	114	110.3
2005	18,200	114.3	112.5
2006	20,856	114.6	112.9
2007	24,721	118.5	113.4
2008	28,898	116.9	110.7
2009	32,244	111.6	112.6
2010	36,539	113.3	109.8
2011	41,799	114.4	108.6
2012	46,769	111.9	109
2013	51,483	110.1	107.3
2014	56,360	109.5	107.2
2015	62,029	110.1	108.5

Sources: National Bureau of Statistics. 2016. China Statistical Yearbook 2016. Beijing: China Statistics Press

Notes: [1] The indices of average wage are defined as the ratios of average wage of employed population in reported period and average wage of employed population in base period (preceding year=100), which reflect the relative changes in average wage of employed population in different periods. The calculation formula is:

$$\text{indices of average wage} = \frac{average\ wage\ of\ employed\ population\ in\ reported\ period}{average\ wage\ of\ employed\ population\ in\ base\ period} \times 100$$

[2] The average real wage means the average wage of employed population excluding price factors. The indices of average real wage are defined as the ratios of average real wages of employed population in reported period and base period (preceding year=100), which imply the relative changes in average real wage of employed population. The calculation formula is:

$$\text{indices of average real wage} = \frac{indices\ of\ average\ wage\ in\ reported\ period}{consumer\ price\ index\ in\ reported\ period} \times 100$$

Given these conditions, it is evident that the old economic development strategies that are largely dependent on labour- intensive industries and exports of low-cost products cannot

contribute to China's economy in the future to the extent that they did in the past three decades. China is losing the advantages arising from its abundant and cheap labour force, which have been the driving force behind the plentiful foreign investments and have promoted the country's economic growth for decades. During the past three decades, China developed its labour-intensive manufacturing industries, winning the title of the world factory. However, as the increasing labour force costs would challenge China's current economic growth pattern, the government should pay more attention to the restructuring of the economy, through technological innovation promotion, transition in economic growth pattern, and adjustments of income redistributions. These and other measures can address the challenges caused by changing demographic and economic conditions in the future and will help avoid the middle-income trap.

3.3 Impact of ageing on labour force in China: Productivity and participation

Advantageous demographic conditions have contributed greatly to the Chinese economy, owing to the abundance of cheap labour force and the declining dependency ratio that have characterised the past three decades. Although China can still rely on the large size of the working-age population, its labour force is aging and is diminishing as a proportion of its total population. In addition, the average wage of employed population is increasing, indicating a rising labour force costs. These changes are accompanied by low labour force productivity rates, which lag behind those in the developed countries. All these challenges would exert unprecedented adverse effects on China's economy and society in the future. At the same time, China will experience an accelerating ageing process in the next two to three decades, resulting in an increasing dependency ratio and growing size of its old population. The ageing process would exhibit significant negative effects on China's labour force supply in the future, including

declining productivity and labour force participation rates, and unfavourable shifts in the age structure and size of the country's labour force. In the next section, the impacts of population ageing on labour force supply in China are examined by investigating the effects of ageing on these three aspects.

3.3.1 Population ageing and productivity

The ageing of French society was noted in 1865, marking the general trend globally (Kolb, 2013). This unprecedented and pervasive ageing process is a global phenomenon without parallel in human history, and has had profound and enduring implications for all facets of human life (UN, 2002). In this context of worldwide population ageing, the implications of population ageing for the economy and society have been extensively studied, with many researchers aiming to establish the relationship between ageing and labour force productivity rates. Some scholars argue that population ageing would decrease labour force participation rates due to the decline in the labour force supply, especially young labour force, and the ageing in the labour force (Thorndike, 1940; Mincer, 1974; Rybash, William and Roodin, 1986; Yu, 1995; Yang and Lu, 2006; Zhang, 2010). This is particularly problematic for technology-intensive industries (Bartel and Sicherman, 1993; Ahituv and Zeira, 2011). Studies conducted in South Korea show that the labour force productivity rates would dramatically decline around 2020 because of population ageing. However, a positive effect of workforce ageing on productivity is also supported by many researchers (Romer, 1987; McMillan and Baesel, 1990; Malmberg, 1993; Feyrer, 2008; Malmberg, Lindh and Halvarsson, 2008). These authors demonstrate a positive relationship between workforce ageing and productivity growth (Malmberg et al., 2008). Scholars argue that population ageing would lead to increased investments in individual education and human capital, which would have a further positive

effect on the labour force productivity rates (Scarth, 2002). Culter (1990) estimated that the productivity rates would increase by 0.6% for each 1% decline in the labour force growth rates, suggesting that ageing society would actually increase the productivity rates. Previous studies provide the insight of changes in labour force structure and productivity rates, though without agreement on the direction of effects of ageing labour force on productivity.

China has relatively low labour force productivity rates when compared with the developed countries, indicating that it requires a larger labour force to generate the same output. Moreover, China has historically depended on its abundant and cheap labour force to boost its economy, as the government adopted the development strategy largely reliant on labour-intensive industries and exports of low-cost products. However, this is no longer sustainable, owing to the rapidly ageing population in the country. Furthermore, in the secondary sector, including mining, manufacturing, and construction, which requires large labour force input, productivity is the highest in the economy. If China continues its economic growth strategy, the declining size of the young labour force and the increasing proportion of old workers would significantly decrease the aggregated productivity, considering that the middle-aged workers exhibit the greatest productivity (Yu, 1995). Around 2035, when the country would be faced with an oldest labour force, the aggregated productivity rate in China would be lowest, due to the ageing workforce (Yang and Lu, 2006). Although population ageing might bring increasing investments in individual education and human capital, the effects of these changes would take a long time to manifest, along with the changes in demographic environments and economic conditions, while the country would still face great challenges in its economic transition from a labour-intensive to a technology-driven one. As the rate at which the population is ageing is increasing, China's aggregated productivity would decline in the short term, after which

positive changes may become apparent, due to the gradual accumulation of human capital in the long term.

3.3.2 Population ageing and labour force participation rates

Labour force participation rates play an important role in the labour market. Compared with the developed countries, China has a higher labour force participation rate, as determined by its economic development stages, national income, and other socio-economic factors. Based on the most recent data provided by the World Bank, the labour force participation rate (as a percentage of total population aged 15−64) in China was 77.6% in 2014, compared to 68.7% as the world's average (World Bank, 2016). However, the gap between the labour force participation rate in China and those in other developed countries has narrowed during the past decades. China's labour force participation rate was 84.2% in 1990, compared to 75.7% in the United States and 67.7% in the European Union (World Bank, 2016). This gap narrowed, as the labour force participation rates in developed countries and regions remained relatively constant, while China's labour force participation rates declined, leading to a convergence between China and these countries or regions.

The labour force participation rate in China experienced a considerable decline in the last two to three decades, from around 85% in 1990 to 79.8% in 2015 (NBS, 2016). Worldwide, a decline in labour force participation rates occurred in many countries and regions in the same period (Mincer, 2001). China has been experiencing this adverse change in its labour force participation rates in recent years (Wang and Lin, 2006). The decline in labour force participation rate in China is closely associated with various factors, including economic growth, expansion of college enrolment, low fertility rates, population ageing, and unemployment (Cai and Wang, 2004; Peng, 2005; Peng and Fausten, 2006; Mishra, Nielsen and Smyth, 2010; Guo

and Che, 2011; Wang and Tong, 2015). In particular, the increase in the college enrolment rates in China that was noted in the last decade has resulted in a decline in the number of young individuals entering the labour force market (Guo and Che, 2011; Zhai and Yang, 2011). The expansion of college enrolment significantly reduces the youth labour force participation rates in China, resulting in a decline in the overall labour force participation rate (Figure 3.8).

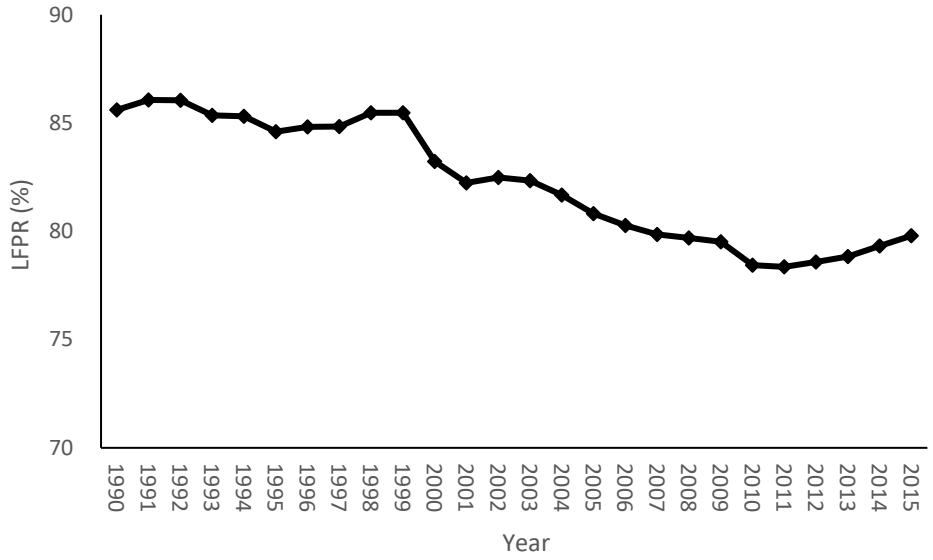

Figure 3. 8 Overall labour force participation rates in China, 1990-2015

Sources: National Bureau of Statistics. 2016. China Statistical Yearbook 2015. Beijing: China Statistics Press.

Along with the changes in overall labour force participation rates, China's age-specific labour force participation rates that are characterised by an inverted U-shape show some distinct changes as well. The Chinese age-specific labour force participation rates in 2000 and 2010 are presented in Figure 3.9, which are based on the population census data in 2000 and 2010, clearly show the declining youth labour force participation rates for both males and females in the analysed period. As can be seen from the graph, the participation rate of those aged 15−19 was 70.54% and that of labour force aged 20−29 was 92.64% in 1990. However, twenty years later,

these figures declined to 33.47% and 79.93% in 2010, respectively (NBS, 2012). In addition, the labour force participation rate also experienced a decline among women aged 25−40 and 50−55. These findings suggest that, in the analysed period, female labour force participation rate declined more rapidly than did male labour force participation rate.

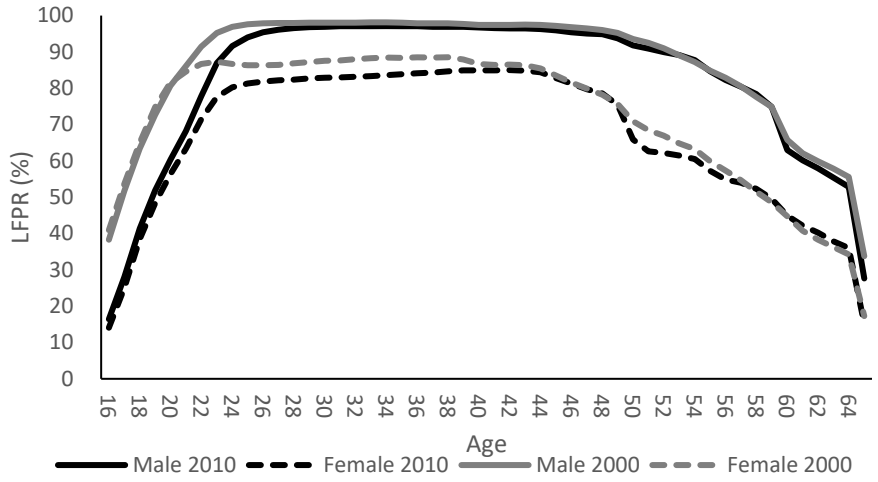

Figure 3. 9 Age-specific labour force participation rates in China, 2000 and 2010

Sources: Population Census Office under the State Council, Department of Social Science and Technique Statistics at National Bureau of Statistics. 2002. Tabulation on the 2000 Population Census of the People's Republic of China. Beijing: China Statistics Press; Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

Ageing plays a significant role in the decline of overall labour force participation rates in China during the period. To further examine the impacts of population ageing on the labour force participation rates in China during 2000−2010 (considering China entered ageing society in 2000, this study chooses 2000 as the start of analysis period), the standardisation method was employed to exclude the effect of population age structure. First, the 2000 Chinese population was defined as the standard population, with the assumption that the 2010 Chinese population

would exhibit the same age structure as that in 2000. Second, the numbers of adjusted single-age population aged 16 and above in 2010 ($P^{adj}_{aged\ x\ in\ 2010}$) were calculated using the observed population numbers in 2010 and the age structure in 2000. Third, the numbers of expected labour force aged 16 and above in 2010 (LF^{e}_{2010}) were calculated using the age-specific labour force participation rates and adjusted single-age population in 2010. Next, the standardised overall labour force participation rate in 2010 ($LFPR^{s}_{2010}$) was calculated using the expected labour force and the observed population size for those aged 16 and above in 2010. Last, the difference between the expected and the observed overall labour force participation rates in 2010 was obtained, along with the ratio of this difference and the difference between the observed overall labour force participation rates in 2000 and 2010. This approach allowed investigating the contribution of population ageing to the changes in the overall labour force participation rates during the 2000−2010 period with the value of the calculated ratio in last step above.

The formula for the adjusted population aged 16 and above in 2010 ($P^{adj}_{aged\ x\ in\ 2010}$) is given below:

$$P^{adj}_{aged\ x\ in\ 2010} = P_{aged\ x\ in\ 2010} * \frac{P_{aged\ x\ in\ 2000}}{P_{aged\ 16+\ in\ 2000}}$$

The formula for the expected labour force in 2010 (LF^{e}_{2010}) is:

$$LF^{e}_{2010} = \sum_{x=16}^{65+} (LFPR_{aged\ x\ in\ 2010} * P^{adj}_{aged\ x\ in\ 2010} * 100)$$

The formula used to calculate the standardised overall labour force participation rate in 2010 ($LFPR^{s}_{2010}$) is given by:

$$LFPR^{s}_{2010} = \frac{LF^{e}_{2010}}{P_{aged\ 16+\ in\ 2010}} * 100$$

The effect of population ageing on the decline in the overall labour force participation (δ) during 2000−2010 is calculated using the expression:

$$\delta = \frac{LFPR^{s}_{2010} - LFPR_{2010}}{LFPR_{2000} - LFPR_{2010}} * 100$$

The above calculations were performed using the Chinese population census data in 2000 and 2010, allowing the standardised overall labour force participation rate in 2010 to be estimated. Using the formulas above, the standardised overall labour force participation rate in 2010 is 72.6% (The detailed calculation steps and results are referred to as Appendix B). The results reveal that it is higher than the observed overall labour force participation rate in 2010 by 1.67%, excluding the effect of population age structure. The population ageing contributes about 23.8% to the decline in the overall labour force participation rates during the period from 2000 to 2010, implying that ageing of the China's labour force has had a significant negative effect on the overall labour force participation rates in the analysed period.

3.3.3 Effects of labour force ageing on economic growth

The ageing in labour force has had significant negative effects on productivity and labour force participation rates, resulting in negative effects on the country's economic growth. To further explore the effect of ageing on economic growth, C-D production function was adopted to measure the contribution of population ageing to economic growth.

In the C-D production function, parameters, including labour force, technique and total factor productivity, are estimated using data published by National Bureau of Statistics in China. The data pertaining to total products were sourced from China Statistical Yearbooks for 1990−2010, with exclusion of price inflation using the indices of Gross Domestic Product. The labour force data were obtained from these statistical yearbooks as well. Capital input is difficult to measure, due to the absence of authoritative sources in China. To overcome this issue,

scholars measure and adjust the capital inputs in China based on perpetual inventory method proposed by Goldsmith in 1951 (NBS, 1997; He, Chen and He, 2003; Zhang, Wu and Zhang, 2004; Zhou, 2007; Fan, 2012). As the aim of the present study does not extend to the analysis of the capital input in China, and the focus is on the contribution of labour force to the economy and effects of population ageing on economic growth, the estimated Chinese capital inputs during 2000−2010 that were made in previous studies were utilised (Fan, 2012). These were subjected to perpetual inventory methods, allowing the contribution and effects of labour force on China's economic growth to be estimated.

Using the C-D production function, the contribution of labour force to economic growth in China during 2000−2010 was explored. The results show that the average annual economic growth was about 10% in this period, whereby extensive financial investments were the largest contributor to the rapid economic growth in China. On the other hand, the contribution of labour force to the economic growth is about 10% (Cai, 2014). To further examine the effects of population ageing on the economic growth in China, the C-D production function was adjusted, using total population size and age-specific proportion of labour force as a substitute for labour force input, allowing the effect of age structure to be segregated from the total labour force inputs.

The formula employed for calculating the adjusted production function in this study is given below:

$$\mathrm{L}n(Y) = Ln(\mathrm{A}) + \alpha \cdot Ln\left(\sum_{x=15}^{64} p_x \cdot P\right) + (1-\alpha) \cdot Ln(K)$$

Where Y denotes total production (the real value of all goods and services produced in one given year); A denotes total factor productivity in one given year; P denotes the total population

size in one given year; p_x denotes the proportion of labor force aged x in total population in one given year; K denotes the capital input (the real value of all capital stock) in one given year. α and $(1-\alpha)$ respectively denotes the output elasticity coefficients of labour force input and capital input.

The adjusted production function given above was utilised to estimate the effect of age structure changes in labour force on the economic growth in China, which is presented below:

$$\lambda = \alpha \cdot \frac{\overline{G_{p_x}}}{\bar{G}_Y}$$

Where λ denotes the coefficient of labour force age structure changes in economic growth; G_{p_x} denotes the average growth rate of labour force proportions in the given period; and $\bar{G}_Y$ denotes the average growth rate of total production in the same period.

Using the adjusted production function above, it was established that the labour force ageing (the declining proportion of young labour force aged 16-29) negatively contributed about 1.3% to the economic growth in 2000−2010 (The detailed calculation steps and results are referred to as Appendix C). Although the effect of labour force ageing on economic growth during this period was relatively tiny, it is expected to increase in the future, considering the accelerating ageing process and increasing dependency ratio.

3.4 Labour force supply in China, 2016-2050

China's labour force has experienced some unprecedented changes recently, including a notable decline in its size and proportion, the increasing dependency ratio, ageing workforce and decreasing participation of the youth labour force. The population ageing occurring in China has had significant adverse effects on its labour force, as it decreased productivity and the labour force participation rates, while increasing the dependency burden. Owing to the rapidly ageing

population, China's already low labour force productivity is likely to decline even further, weakening China's economic competitiveness in international trade. In addition, in 2000−2010, the ageing population contributed about 23.8% to the declining of labour force participation rates, confirming the significant influence of population ageing on the labour force supply in China. In the next three decades, China's population will age at an accelerated rate, as those born in 1960s and 1970s enter old ages. Given these issues, the aim of the present study was to explore China's labour force supply in the future using the cohort component population projection method, while taking the new fertility policy into consideration.

To investigate China's labour force supply in the future, population projection method was employed, using the available data on the sex-specific life expectancy at birth, sex ratio at birth, international migration, fertility rates, and base population presented in Appendix A. The analyses focus on the China's labour force changes in the next four decades. The data used in this study includes the Chinese population census data in 2010, such as age-sex-specific population, and national data from China Statistical Yearbooks published by National Bureau of Statistics, such as life expectancy at birth, sex ratio at birth and so on.

3.4.1 Dependency ratios in China, 2016-2050

Since the 1980s, China has been characterised by a decreasing dependency ratio, which contributed about 25% to the GDP growth in the country (Wang et al., 2004). In fact, the total dependency ratio in China declined to the lowest level of 0.34 in 2010, indicating that one working-age person supported 0.34 dependents (children aged 0−14 and the elderly aged 65 and above) (NBS, 2016). Specifically, the old-age dependency ratio has been growing since the 1980s, due to the rapidly aging population. Thus, the decline in the total dependency ratio is mainly due to the drastic decrease in the child dependency ratio, resulting from low fertility

rates in China. Since 2010, the total dependency ratio in China started to increase, which indicates the vanishing of the first demographic dividend in the country.

Using the population projection results, the changes in the dependency ratios in China for 2016−2050 could be estimated, including child dependency ratio and old-age dependency ratio, which are presented in Figure 3.10. According to the results, in the next four decades, China's total dependency ratio would continue to increase, from 0.37 in 2016 to 0.67 in 2050 (Figure 3.10). In other words, one person of working ages (15−64) will have to support 0.67 dependents, which is nearly twice the figure noted for 2010. It can thus be asserted that China will confront a gradually growing dependency burden in the next four decades, which would present great challenges to the social welfare system and public expenditures. Moreover, the child dependency ratio is estimated to increase from 0.22 to 0.25 in the 2017−2025 period, due to the implementation of the two-child policy in 2016. It is further estimated that the child dependency ratio would experience a small decline in the next decade, with the lowest value of 0.20 noted for 2039, followed by a slight increase thereafter. During the next four decades, the changes in the child dependency ratio in China are relatively small, in the 0.20 to 0.25 range, which are significantly different from those in the past three decades. However, the old-age dependency ratio would increase from 0.15 in 2016 to 0.44 in 2050, equivalent to a 2-fold increment in 35 years. In 2016, at 0.15, the old-age dependency ratio was much lower than the child dependency ratio of 0.22. The gap between these two dependency ratios is expected to narrow in the next decade, after which the old-age dependency ratio would exceed the child dependency ratio in 2029. After 2029, the gap between these two ratios in China would start to widen, reaching 0.22 in 2050. As this figure is the same as the child dependency ratio calculated for 2050, it implies that 100 working-age persons would have to support 22 children aged 0−14 and 44 elderly aged

65 and above. The drastic increase in the total dependency ratio in China in the next four decades is due to the rapid population ageing. The most significant difficulty the Chinese government and households would face in the future is that of how to support the elderly, rather than to raise the children, which was historically the main demographic issue in the country.

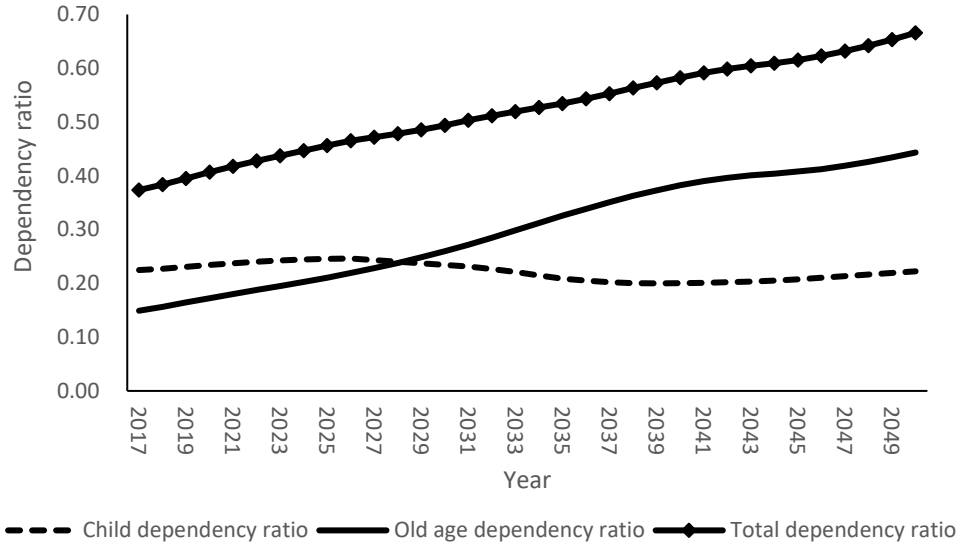

Figure 3. 10 Dependency ratios in China, 2016-2050

Notes: This figure is drawn based on the dependency ratios in China (2016-2050) projected in this study.

3.4.2 The working-age population in China, 2016-2050

The abundance of cheap labour force enabled China to experience rapid economic growth in the past several decades. However, this progress is unsustainable, considering the country's changing demographic conditions. The size of working-age population in China reached the peak in 2013, when it was estimated at 1,006 million (NBS, 2016). In the future, the working-age population (those aged 15−64) in China would gradually decrease, from currently more than 1,000 million to less than 900 million in 2037, and further to 786 million in 2050 (Figure 3.11). During the next 35 years, the working-age population in China would decline by 220

million, equivalent to a negative annual growth rate of -0.7%. At the same time, the proportion of working-age population in the country's total population would experience a continuous decline. At present, more than 70% of Chinese population is of working age, and can thereby contribute to the economy. However, the proportion of working-age population in China would decline to 60% in 2048.

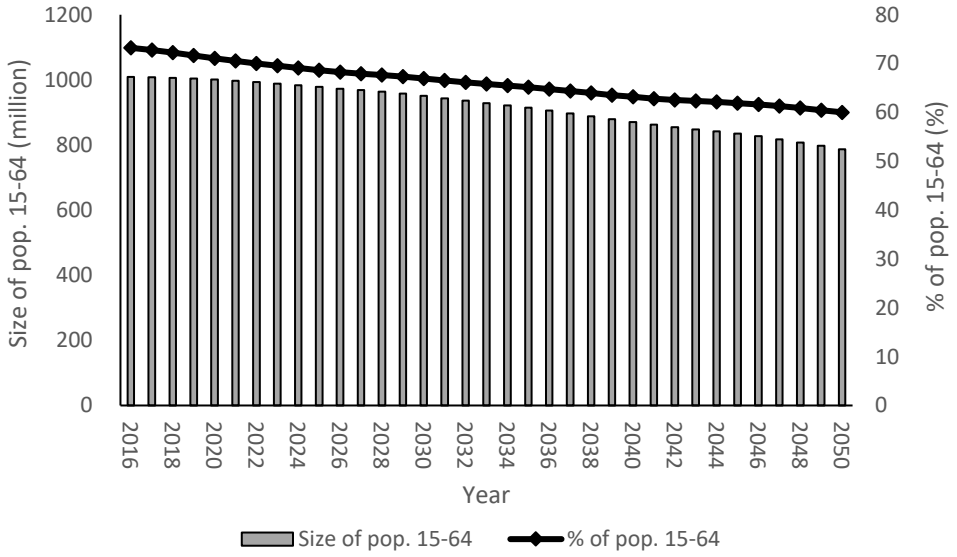

Figure 3. 11 Size and percent of working-age population in China, 2016-2050

Notes: This figure is drawn based on the working-age populatioon in China (2016-2050) projected in this study.

In addition to the changes in size and proportion of working-age population in the future, the age composition of this segment of population will undergo changes as well. In the base year of 2016, those aged 15−29 comprised 29.5% of the total working-age population, while those aged 50 and above contributed to the workforce by 26.5%. The largest proportion in working age population pertained to the middle-aged labour force (aged 30−49), at 44%. However, the age structure of working age population is expected to change markedly in the next three to four decades (Figure 3.12). The share of young workforce would decrease to

24.2%, and the proportion of middle-aged labour force would decline to 39.3% in 2050. Meanwhile, the older labour force (aged 50 and above) would comprise an increasing proportion of the working-age population, contributing by 36.5% in 2050. In the next 35 years, the participation of both the young and middle-aged labour force will decline, resulting in an aging labour force in China. This ageing process is also evident in the changes in the average age of working-age population, which will increase from 39.2 in 2016 to 41.8 in 2050.

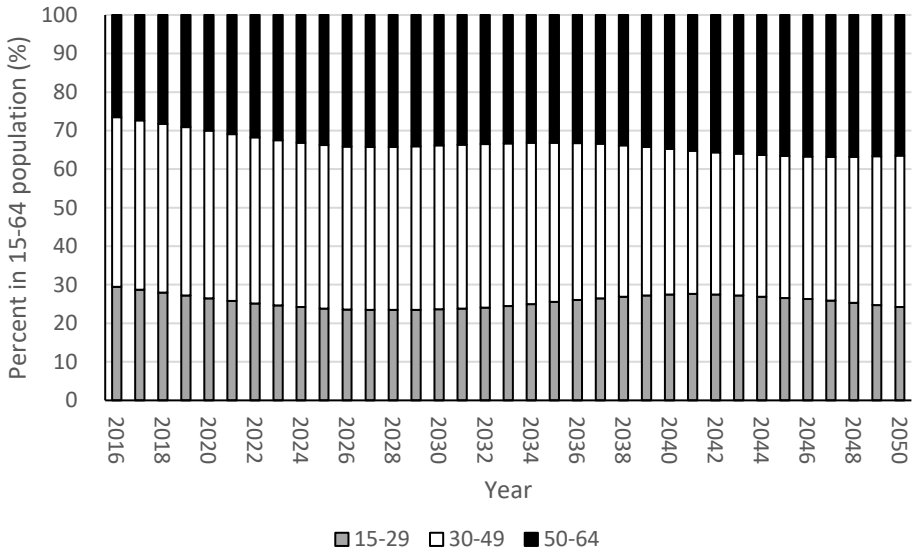

Figure 3. 12 Age composition of working-age population in China, 2016-2050

Notes: This figure is drawn based on the age structure of working-age population in China (2016-2050) projected in this study.

3.4.3 Labour force supply in China, 2016-2050

In the present study, the working-age population in China was projected for the next 35 years, including the size and proportion, the age structure, and the dependency ratio. These results reflect the changes in the labour force supply in the future to a large degree. However, it is also important to investigate China's labour force supply in the future, considering the gap between working-age population and labour force due to participation rates.

If the age-specific labour force participation rates remained at the 2010 levels, this would allow measuring the labour force or economically active population in the next four decades in China. Obviously, China exhibits an inverted-U shaped pattern in its age-specific labour force participation rates (Table 3.2). Consequently, the labour force in China for the next three decades was projected by multiplying age-specific labour force participation rates ($LFPR_x$) and the corresponding population numbers (P_x) in given years.

Table 3. 2 Age-specific labour force participation rates in China, 2010 (%)

Age groups	Labour force participation rates
16-19	33.47
20-24	72.76
25-29	88.89
30-34	90.16
35-39	90.75
40-44	90.71
45-49	87.66
50-54	76.31
55-59	67.14
60-64	49.52
65-69	36.25
70-74	19.66
75+	8.15

Sources: Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

The labour force supply in China in the next four decades was estimated considering the economically inactive working-age population as well as old labour force (aged 65 and above), as presented in Table 3.3. As can be seen from the data, despite the large working-age population (around 1,000 million at present China), the labour force, or economically active population

(including employed and unemployed population) was about 800 million in China, due to schooling, retirement, disability and other reasons. This discrepancy reveals a large gap between labour force and working-age population size, mandating that labour force participation rates be taken into consideration when projecting labour force supply in the future. Projection results of labour force supply in China show that China would be confronted with a declining labour force supply in the next four decades. Specifically, the size of labour force supply in China before 2020 would remain almost unchanged, at around 800 million, before starting to decline. In 2035, Chinese labour force would decline to less than 740 million and further to less than 650 million in 2050 (Table 3.3).

At the same time, China's labour force will continue to age in the structure. Obviously, the size of young labour force (aged 16−29) shows a significant decline during the next four decades. In fact, the labour force in all age groups among 16−64 would decrease in size during this period, resulting in reduction in labour force supply in China. The findings also reveal a decline in the share of young labour force in China during 2020−2050 (Table 3.4). This adverse trend would negatively affect the acquisition and dissemination of new knowledge and skills, which might result in low productivity.

Nonetheless, the government and companies should pay particular attention on the aging process in labour force in the future. The old labour force (those aged 60 and above) in China is presently small both in size and share, and is estimated to reach 78 million, equivalent to about 9% of the total labour force, by 2020. Three decades later, the size of the old labour force is projected to increase to 117 million, corresponding to 18% of the total labour force in 2050 (Table 3.4). These findings suggest that one of every five labour force would be aged 60 or above in 2050, who should be retired based on the national regulations in China. If the

retirement age in China is postponed in the future and the participation rate of old labour force increased along with socio-economic development, the size and share of old labour force in the future would be larger than projected in this study. It highlights the significance and concern of the employment of elderly persons in the country. The findings based on the labour force projections suggest that China is facing challenges pertaining to both size and age structure of its labour force. These projection results may assist the policy makers in making related policies to support the employment of the elderly in the future and adjusting retirement ages in the country.

Table 3. 3 Labour force supply in China, 2020-2050 (million)

	2020	2025	2030	2035	2040	2045	2050
16-19	21.41	18.30	20.76	23.36	20.22	16.48	15.05
20-24	63.00	57.33	49.32	56.77	63.83	53.53	44.20
25-29	88.31	76.76	69.88	60.12	69.21	77.83	65.27
30-34	105.67	89.30	77.65	70.70	60.83	70.04	78.78
35-39	95.17	105.97	89.58	77.90	70.94	61.06	70.31
40-44	86.89	94.64	105.42	89.14	77.54	70.63	60.81
45-49	103.11	83.23	90.72	101.10	85.51	74.42	67.82
50-54	93.63	88.44	71.46	77.97	86.95	73.59	64.09
55-59	66.27	80.34	76.00	61.49	67.20	75.02	63.54
60-64	39.12	46.89	56.99	54.00	43.79	47.97	53.64
65-69	25.34	26.69	32.16	39.21	37.25	30.31	33.34
70-74	9.38	12.19	12.91	15.67	19.20	18.32	14.98
75+	4.47	5.73	7.55	8.96	10.81	13.34	14.72
Total	801.77	785.81	760.39	736.38	713.28	682.54	646.55

Notes: Normally the labour fource are defined as those aged 15-19, however, the National Bureau of Statistics in China publishes the labour force participation rate from the age of 16, which is used in the estimations.

Table 3. 4 Age composition of labour force in China, 2020-2050 (%)

	2020	2025	2030	2035	2040	2045	2050
16-19	2.67	2.33	2.73	3.17	2.84	2.41	2.33
20-24	7.86	7.30	6.49	7.71	8.95	7.84	6.84
25-29	11.01	9.77	9.19	8.16	9.70	11.40	10.10
30-34	13.18	11.36	10.21	9.60	8.53	10.26	12.18
35-39	11.87	13.49	11.78	10.58	9.95	8.95	10.87
40-44	10.84	12.04	13.86	12.10	10.87	10.35	9.40
45-49	12.86	10.59	11.93	13.73	11.99	10.90	10.49
50-54	11.68	11.25	9.40	10.59	12.19	10.78	9.91
55-59	8.27	10.22	9.99	8.35	9.42	10.99	9.83
60-64	4.88	5.97	7.49	7.33	6.14	7.03	8.30
65-69	3.16	3.40	4.23	5.32	5.22	4.44	5.16
70-74	1.17	1.55	1.70	2.13	2.69	2.68	2.32
75+	0.56	0.73	0.99	1.22	1.52	1.95	2.28

Notes: This figure is drawn based on the age structure of labour force in China (2020-2050) projected in this study.

3.5 Conclusions and discussion

China has experienced a rapid demographic transition process in the last three decades, owing to the rapidly declining fertility and mortality rates. Consequently, the Chinese population is experiencing profound changes in its age structure, one of which is the changing labour force in the country. Based on the latest data published by the National Bureau of Statistics in China, the size of working age population (those aged 15−64) in the country reached the peak value in 2013, at 1,006 million (NBS, 2016). Taking the labour force participation rates into consideration, the size of labour force, or economically active population providing labour for the economy, is about 800 million at present, confirming that the country still benefits from an abundant labour force. In fact, the abundance of cheap labour and the declining dependency ratio in China have had significant positive effects on the economic growth in the country, contributing about 20-25% to the contemporary GDP growth during 1982−2000 (Wang et al., 2004; Bloom and Finlay, 2009). However, the changes in the demographic environment and

economic conditions that have been noted in the recent years brought various challenges to the economy and society in the country, including an increasing dependency ratio, a growing elderly population, increasing labour costs, the forthcoming economic slowdown, and enlarging gaps in social endowment pension system. Against this backdrop, the Chinese government started implementing new reforms and related supporting polices to deal with the ensuing challenges and opportunities in the future, one of which is the fertility policy adjustment that was put in place in 2016. Due to the long-term low fertility rates, which have been much lower than the replacement level for more than twenty years, and the accelerating population ageing process, China foresees the challenges both to its economy and society caused by the demographic consequences of the three-decade-long one-child policy. The implementation of the two-child policy was aimed to address this issue and is likely to affect the labour force supply in China in the future.

In 2000, China started to become an ageing society, as indicated by the share of the old population aged 65 and above, which exceeded 7% of the total population (NBS, 2002). In the past fifteen years, the population ageing began to gradually affect the economy and society in the country. The aim of the present study was thus to examine the challenges and effects of ageing on the labour force in China. The findings reported in this chapter show that the ageing process would negatively affect the labour force productivity in China, considering the poorer capability of absorbing new knowledge and techniques, and worse physical capacity of the elderly. In the next decade, China might be confronted with a decreasing productivity due to the population ageing. Still, in the long term, the government and households are expected to increase investments in education and human capital, which might lead to a greater productivity, based on international experiences in developed countries. In addition, population ageing was

shown to exhibit significant negative effects on the labour force participation rates in China during the 2000 to 2010 period. The ageing labour force, characterised by an increasing proportion of old labour force and a decreasing share of young labour force, has resulted in a decline of 1.7% percent out of total decline of 7% during the decades, which suggests that the labour force ageing contributes to about 24% to the overall decline in the labour force participation rates noted in 2000−2010. Moreover, the ageing labour force negatively affected the economic growth in China during the same period, about 1.3% of contemporary GDP growth. If this ageing trend increases in the future, the impacts of ageing on the economy would be even greater.

Using these projection results, the labour force supply in China was estimated for the next four decades. As the findings revealed, the dependency ratio would continuously increase in the next 35 years. At 0.34, China witnessed its lowest dependency ratio in 2010 (NBS, 2012). In 2050, the dependency ratio in China would reach 0.67, indicating that three workers would support two dependent persons. Specifically, the increasing dependency ratio that is projected for the next four decades is mainly due to the increase in the old-age dependency ratio, resulting from rapid population ageing in China, as the child dependency ratio would only fluctuate between 0.20 and 0.25 in the next future. This marks the shift from the declining dependency ratios in past several decades, which were mostly attributed to the declining child dependency ratio in the country, caused by the rapidly decreasing fertility rates.

The labour force in China would experience a downward trend both in size and proportion, under the assumption of constant labour force participation rates. Before 2045, the size of labour force in China would exceed 700 million, decreasing by about 100 million from the 2016 levels. The declining labour force supply in China suggests that the old economic development strategy

that is primarily reliant on exports of low-cost products and labour-intensive industries cannot continue in the country. At present, Chinese economy is in transition, which requires the policy makers and companies to seek appropriate and efficient solutions for these unprecedented changes and challenges. It should also be recognised that the significant achievements in education could greatly improve the skills and technical capability of labour force, which might lead to increasing human capital accumulation and improved productivity, resulting in sustainable economic growth, despite the declining and ageing labour force in the future. Based on the population census data in China, the proportion of labour force with college and higher education in the country increased from 4.66% in 2000 to 11.06% in 2010 (NBS, 2002; NBS, 2012). The number of Chinese citizens with college degree and above per 100,000 persons increased from 1,422 in 1990 and 3,611 in 2000 to 8,930 in 2010 (NBS, 1993; NBS, 2002; NBS, 2012), which also suggests a significant positive development in education in China.

China's economy is experiencing a crucial transition, which would significantly affect the country's future and its ability to avoid the middle-income trap. As the essential production input, the labour force supply in the future will continue to play an important role in the economic growth. The findings reported in this chapter revealed the challenges, opportunities and demographic changes of labour force supply in China in the next four decades. These findings suggest that the Chinese economy would face a declining and ageing labour force in the next 35 years, resulting from the rapid population ageing. Despite the negative effects of ageing on labour force participation rates and productivity, the country could also capitalise on some opportunities. Population ageing would inspire the government and households to invest more into human capital, which might result in long-term sustainability of the economic growth in China. Consequently, the economy in China would be confronted with both challenges and

opportunities caused by the changing labour force in the future. The findings reported here thus have important policy implications for the government and policy makers. To seize the opportunities and smoothly complete the economic transition in the country, the Chinese government should gradually restructure its economy, and must abandon the labour-intensive and export-dependent development strategy, replacing it with a technology-driven one. In addition, China should continue to pursue strategies aimed at increasing domestic consumption, which might further boost its economy in the future.

Chapter 4 “Getting old before getting rich”: Impact of Ageing on Household Savings in China

4.1 Introduction

From the early 1970s to the 1990s, China experienced a rapid demographic transition process, for which European countries required more than one hundred years (Li, 2000; Liu, Wei and Ren, 2012). Considering its less-developed economy and large population in the country, the fact that China successfully completed this process in such a short period could be seen as a miracle. In the meantime, the historical demographic transition took place in the Chinese population, shifting from a pre-modern regime of high fertility and high mortality rates to a post-modern one in which both rates are low (Li, 2000). The Total Fertility Rate in the country has been below the replacement level for more than 20 years since the 1990s, declining from Total Fertility Rate of 5.8 in the 1970s to about 2.1 (the replacement level) in 1990 and then 1.5 in 2010 (Chen, 2008; Yu, 2009; Jin, 2014). Life expectancy at birth shows a remarkable increase from less than 50 years in the 1950s to about 75 years in 2010 (NBS, 2012). During the period of 1980-2010, the Chinese population presents a declining dependency ratio, resulting from the drastic decline in child dependency ratio (NBS, 2016). It is clear that the rapid demographic transition process in China with fast decline in both fertility and mortality rates indicates profound changes in its population age structure.

Along with China's rapid demographic transition, its economy underwent remarkable progress. In terms of Gross Domestic Product (GDP), China's economy increased by more than 25 times from the time of the Reforms and Opening Up in 1978 to 2015, after excluding influence of price index (NBS, 2016). The rapid economic growth and drastic demographic changes in China have prompted heated debates on the relationship between economic growth

and population age structure in the country. Worldwide, an extensive body of research has been published since the 1990s, marking the shift in focus from the link between population size or population growth and economic growth (Cai, 2008). Since the 1990s, scholars have paid more attention on population age structure when analysing the effects of demographic factors on economic growth. In particular, researches based on the case of East Asian Miracle revealed growing concern for the economic growth due to the changes in the population age structure (Bloom, 1998; Bloom and Finlay, 2008). Most of the pertinent research conducted in China's case was published after 2000. Authors of these studies posit that population age structure plays an important role in China's rapid economic growth process, which formulated the first demographic dividend in the country (Wang et al., 2004; Wang and Mason, 2006; Cai, 2008). Since the 1980s, the total dependency ratio in China has been declining, promoting China's socio-economic development through abundant and cheap labour force supply (Cai, 2004; Chen, 2008). It is estimated that, as the dependency ratio declines by 1%, the GDP increases by 0.115% (Wang et al., 2004). This assertion is based on the data for 1982−2000, when the declining total dependency ratio contributed 20–25% to the contemporary GDP growth in China.

Further studies analysed the mechanisms through which population age structure affects the economic growth in China, particularly focusing on savings and investments. In addition to the abundant labour force supply and long-term dependency ratio decline, scholars argued that the economic miracle has far relied on the large amounts of government-led investments in the country (Chen and Feng, 2000; Liu, Burridge and Sinclair, 2002; Lin, Cai and Li, 2003; Yuan and Li, 2005; Li, Yin and Chen, 2007). Since the Reforms and Opening Up in 1978, the annual rate of capital accumulation in China has been 30–40% of GDP, due to the much higher savings rate than the economic growth rate (Li and Yin, 2005; Lin, Cai and Li, 2016). Obviously, the

Chinese economy has been accompanied by three "high rates" over past three decades, namely high savings rate, high investment rate and high growth rate (Li and Yin, 2005). As the most important source of investments, the domestic savings rate plays a significant role in China's economic growth (Mason, 1988), which has always been a topic of interest in the field of population age structure and economic growth. China has been the country with the highest savings rate in the world since 2000 (World Bank, 2001), which is referred to as China's high savings puzzle. The phenomenon of high savings rate in China further inspires the debates on the topic of population age structure and savings, especially with an ageing population in the country (Yuan and Song, 2000; Horioka and Wan, 2007; Liu and Zhang, 2009; Chamon and Prasad, 2010; Fan and Zhu, 2012; Yang and Zhang, 2013; Liu and Liu, 2015; Ma, Song and Fu, 2015). Some scholars posit that the increasing old-age dependency ratio negatively affects the savings rate in China, due to growing medical expenditures and economic slow-down (Loayza, Schmidt-Hebbel and Serven, 2000; Liu and Zhang, 2009; Yang and Zhang, 2013). However, other studies are of opposite view that old-age dependency ratio makes a positive effect on savings rate, due to increase in precautionary savings regarding supporting the old-age life (Yuan and Song, 2000; Liu and Liu, 2015). The incongruence of conclusions drawn in previous studies on the relationship between ageing and savings prompts the analyses of this present study, which aims to examine the impacts of aging on household savings based on the Chinese households' experiences from both macro and micro perspective.

4.2 Population ageing and savings rate in China

4.2.1 Population ageing in China

Since France firstly entered an ageing society in 1865, with the proportion of people aged 65 and above exceeding 7% (Kolb, 2013), population ageing has gradually become a worldwide

demographic issue with prevalence and profound implications in human society. By the end of the twentieth century, most developed countries were undergoing population ageing, and even many developing countries, especially in Asian and Latin American countries that experienced significant and sometimes quite rapid fertility declines (UN, 2013). Based on the recent population projection results published by the United Nations, ageing will become a virtually universal phenomenon in the twenty-first century, although it will progress with different intensity and speed across countries and regions (UN, 2015).

As the important part of the world population, the Chinese population is experiencing an ageing process as well, which is largely due to its faster demographic transition process compared to the developed countries. In the 1970s, China's fertility rate started to decline sharply, due to the implementation of the one-child policy that was enforced throughout the country (Poston et al., 2005; Yu, 2009). As a result, the total fertility rate, which was about 5.8 in the early 1970s, declined to around 1.5 in 2010 (Chen, 2008; Jin, 2014). Owing to the rapid declines in fertility and mortality rates, the country witnessed a dramatically changing population over past six decades and entered the ageing society at the turning of twenty-first century (NBS, 2002). Based on the Chinese population census data in 1964, the country had a young population, with a large share of young children aged 0–14 (40.7%), as shown in a triangle population pyramid (Figure 4.1). However, the population presented significantly different characteristics in 2010, with a narrower bottom in the population pyramid, indicating the decline in the proportion of young children aged 0–14 over the past five decades (Figure 4.2).

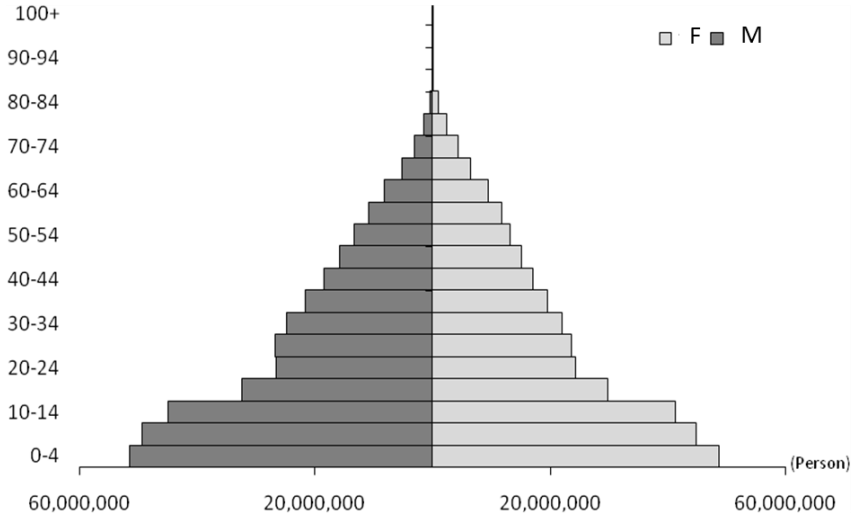

Figure 4. 1 Population Pyramid in China, 1964

Sources: Population Census Office under the State Council, and Department of Population Statistics at National Bureau of Statistics. 1985. 1982 Population Census of China: Results of Computer Tabulation. Beijing: China Statistics Press.

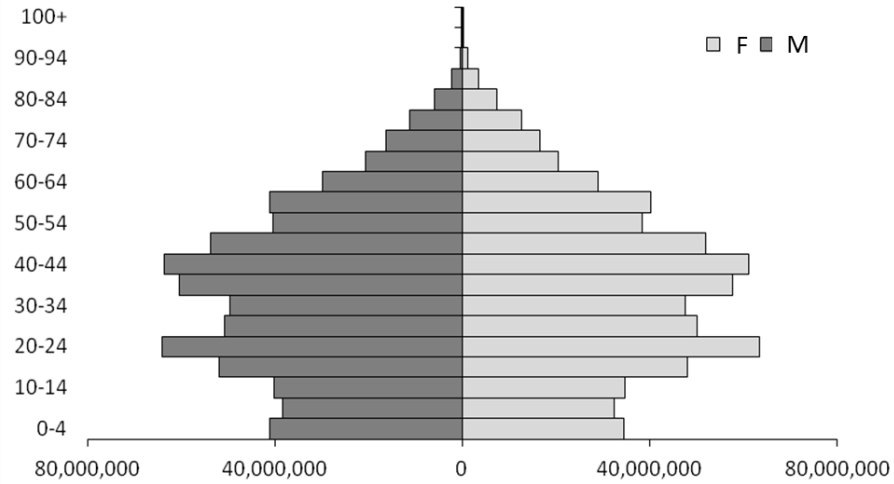

Figure 4. 2 Population pyramid in China, 2010

Sources: Population census office under the state council, Department of population and employment statistics, National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China, Beijing: China Statistics Press

It further shows the ageing process in the Chinese population, with the size and proportion of the old population (those aged 65 and above) presented in Figure 4.3. In 1953, China had only 25.7 million people aged 65 and older, which was equivalent to 4.4% of its population (NBS, 1985). Afterward, the size and proportion of the old population aged 65 and above presented a short-term decline, with the size of 24.7 million and the share of 3.6% in 1964 (NBS, 1985). From the 1960s, the country met a continuously growing old population. Four decades later, people aged 60 and above contributed up to 10.5% (130 million) to the Chinese population, while those aged 65 and above (88 million) comprised 7.1% of the population (NBS, 2002). Meanwhile, it indicates that the Chinese population started to age. In 2010, the number of the elderly aged 65 and above in China increased to 118.8 million, with the share of 8.87% of the total population (NBS, 2012). As these figures show, China has been experiencing a rapid population ageing process in recent years, especially after 2000.

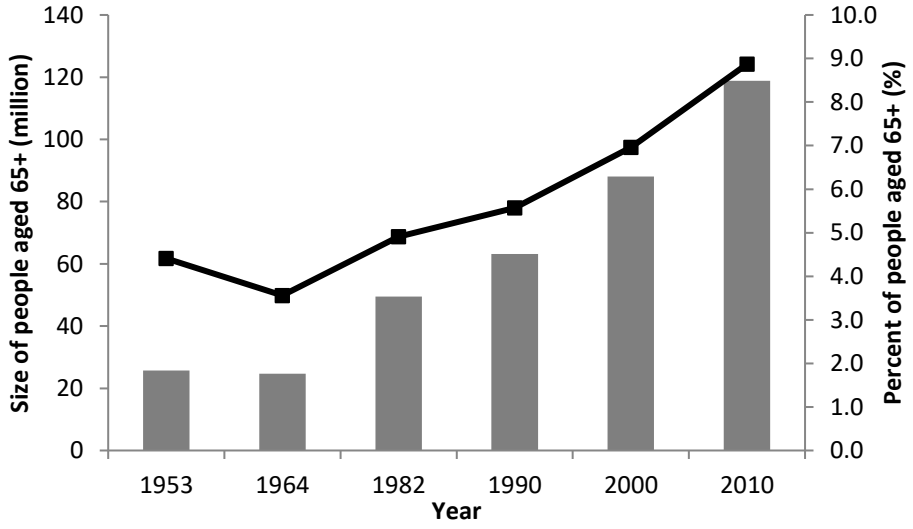

Figure 4. 3 Size and percent of old population in China

Notes: Figure 4.3 is drawn based on the population census data of China in 1953, 1964, 1982, 1990, 2000 and 2010.

China will experience an accelerated population ageing process in the near future, as will most Asian countries. If China keeps implementing its one-child policy and without considering international migration, the number of elderly population (those aged 65 and older) will exceed 200 million in 2025, contributing about 14.2% to the country's population. In 2037, the number of the elderly will further rise to more than 300 million, equivalent to 21.8%, and will reach 329 million (25%) in 2050. These findings confirm that, in the next four decades, China's population ageing will accelerate (Figure 4.4). In addition, the population ageing in China is ahead of socio-economic development, which is one of the key characteristics of China's population ageing process, referred to as "getting old before getting rich", and is opposite to that observed in developed countries (Lu, 2007). In this context, the demographic shift would produce unprecedented challenges and opportunities for the society and economy in the country (Zuo, 2001; Cai et al., 2004; Jiang and Wan, 2005; Lu, 2007; Sun and Zhu, 2008).

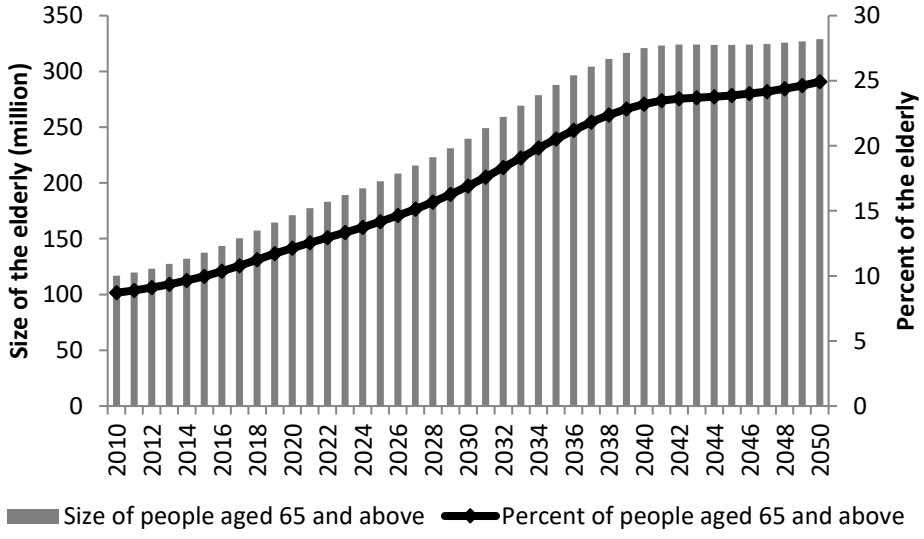

Figure 4. 4 Size and percent of old population in Chin, 2010-2050

Notes: Figure 4.4 is drawn based on the population projection results computed by the author using component factor population projection method.

4.2.2 High savings rates in China

Consumption, investments, and exports are figuratively described as the "three horses of Troika" driving China's economic growth (People's Daily, 2006). In the past three decades, China's rapid economic growth is boosted by its development strategy reliant on large investments and exports, as well as high savings rate (Lin et al., 2016). In fact, China is one of the countries with the highest savings rate in the world (Xu, 2012), with the national savings rate exceeding 50% in 2007 (Ai and Wang, 2008), which is referred to as China's high savings puzzle. Specifically, the national savings rate in China has been increasing over the past three decades. Based on the World Bank data, China's savings rate has been much higher during the period of 1970-2010, when compared with Japan, South Korea and India (Figure 4.5). After 1990s, China's savings rate exceeded 40%, reaching 50% by 2006. The extraordinarily high savings rate in China inspires a great deal of studies, which were particularly focusing on the topic of the determinants to this phenomenon, including economic growth, social security system, cultural factors, and demographic factors (Yuan and Song, 2000; Horioka and Wan, 2007; Ren and Qin, 2006; Li and Yin, 2007; Liu, Hu and Lang, 2012; Chen and Yang, 2013; Ma and Zhou, 2014).

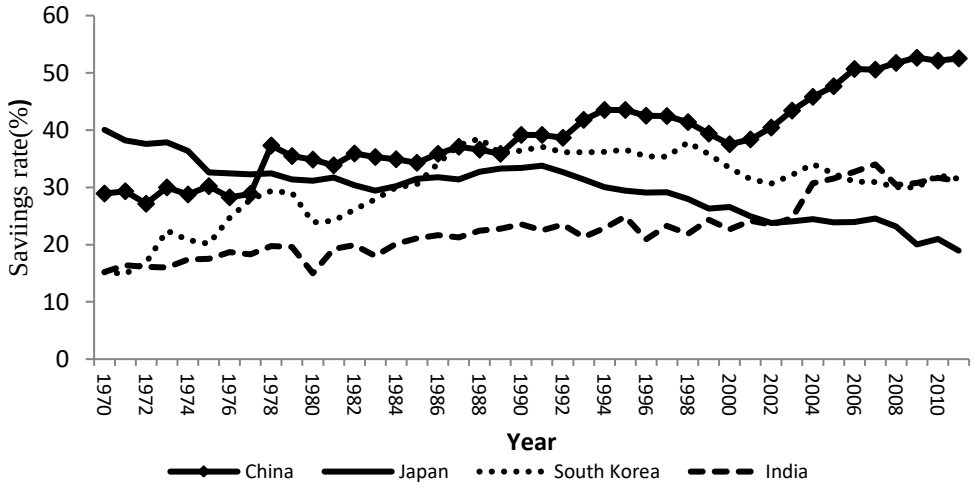

Figure 4. 5 Savings rate in China, Japan, South Korea and India, 1970-2010

Notes: The savings rate is defined as proportion of national savings in contemporary GDP.

The savings rate in China has continued to increase over the past three decades, resulting in China being recognised as the country with the highest savings rate in the world. However, given China's dual socio-economic structure, it is of significance and importance to investigate the urban and rural savings rate in the country separately. China's savings rate in the 1980s presented some fluctuations, without consistent pattern of increasing or decreasing. Specifically, in rural areas, the savings rate exhibited an upward trend in the early 1980s, ranging from 14.6% in 1981 to 23% in 1984, after which it started to decline, reaching about 11% in 1989, only half of the rate recorded in 1984 (Figure 4.6). Compared with rural areas, urban areas had a relatively stable savings rate in 1980s, ranging from 10% to 15%. As can be seen from these figures, the savings rate in rural areas was much higher than that in the urban areas, despite drastic fluctuations.

In the 1990s, savings rates experienced rapid growth in both urban and rural areas. However, in the late 1990s, rural areas experienced a much more rapid growth in the savings rates, reaching 28.6% in 1999. Savings rates in urban areas still kept a relatively slow growth pace, increasing to 21.2% in 1999.

In the 21st century, savings rates in urban areas continued to rise, experiencing a stable growth rate and reaching 33.1% in 2013. However, the savings rates in rural areas experienced a relatively stable period in the first five years of the 21st century, with a level higher than 25% before 2005 when a decline started. In 2006, the saving rate in rural areas decreased to 21.1%. In recent years, savings rate in rural areas began an increase to 25%, closing the gap with those recorded in urban areas. Since 1980, with exception of the early 1990s, the savings rate in rural areas was typically much higher than that in urban areas; however, this trend reversed after 2005.

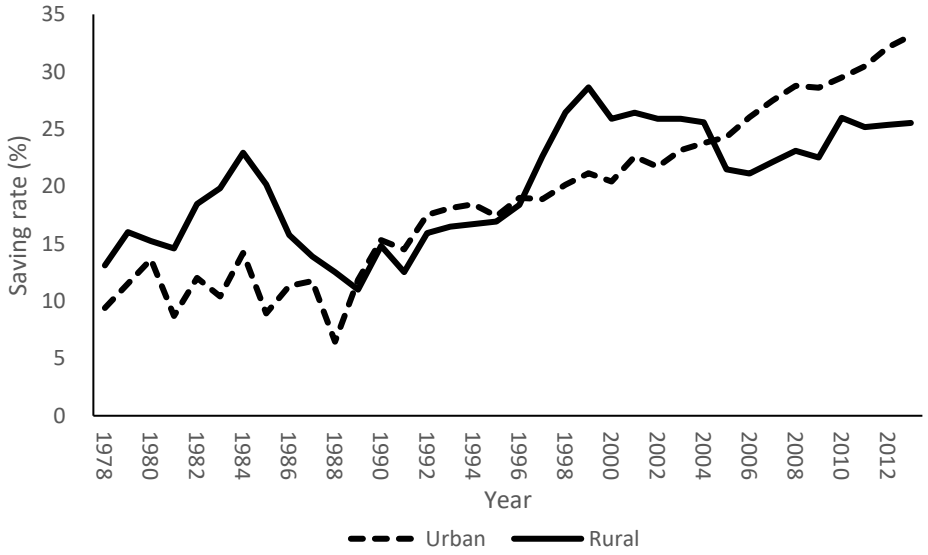

Figure 4. 6 Savings rates in urban and rural in China, 1978-2013

Sources: Department of Comprehensive Statistics at National Bureau of Statistics of People's Republic of China. 2015. China Compendium of Statistics 1949-2014. Beijing: China Statistics Press.*Notes:* The savings rate described in Figure 4.6 is defined as the ratio of gaps between consumption per capita and disposable imcome per capita to disposable income per capita.

4.2.3 Review of the relationship between ageing and savings

The groundwork for analysing the dependence of savings on population was laid in late 1960s (Mason, 1988). In fact, the theoretical analysis of savings and population could be traced back to the early 1950s, when Franco Modigliani and Richard Brumberg developed a theory based on individual observations that people make consumption decisions based on both their income level over their lifetime and current life stage, referred to as life cycle hypothesis (Modigliani and Brumberg, 1956). This theory provides with fundamental analysis framework for researches on population age structure and savings, which was further developed to reveal the relationship between aggregated savings rate and population age structure with the shift from individual to macro perspective (Modigliani, 1976). In addition to life expectancy, dependency ratio also affects household expenditure and savings (Coale and Hoover, 1958). Under the

framework built by life cycle theory, empirical studies based on cross national data were conducted. A ground-breaking analysis on aggregate savings rate was conducted by Leff using gross national savings rate of 74 countries in 1964, which suggested that dependency ratios had significant negative effects on national savings rate (Leff, 1969, 1971). Taking investments demand into account, savings would decrease along with the increasing of dependency ratio, as was the case in some South Asian countries during 1975−1989 (Higgins and Williamson, 1999). Treating child dependency ratio and old-age dependency ratio separately in the analysis, scholars also hold the view of negative relationships between dependency ratio and savings rate (Kelley and Schmidt, 1996; Higgins, 1998; Loayza et al., 2000; Kraay, 2000; Birdsall et al., 2001). Studies on East Asia also show that changes in population age structure during demographic transition process made significant impacts on their respective savings rates as well (Lee and Mason, 2000). However, the findings are questioned due to the variable definitions, sample selection bias and estimation methods employed in analysis. Ram (1982) analysed the relationship between dependency ratio and savings using multiple estimation methods based on the cross data of 121 countries during 1972−1977, positing that dependency ratio made no significant effects on savings rate in LDCs, which is also supported by evidences found in Haque et al. (1999).

Some other scholars are particularly interested in household savings rate (Horioka 2010; Chamon and Prasad 2010). However, due to different variables used in their analyses, the conclusions drawn from these studies are not consistent. Researchers argue that the effects of demographic factors on national savings and household savings are different. Thus, it is of significance to identify and distinguish the two categories of savings rate in analysis. To further explore the rationale of population age structure and savings rate, some extant research provides

micro-level evidence in support of the relationship between demographic factors and savings. Unfortunately, these researchers usually present inconsistent conclusions on the effect of ageing on the savings rate, which are argued potentially due to the intergenerational bequest (Weil, 1994), overestimation of household savings (Miles, 1999), sample selection bias (Deaton and Paxson, 2000), or omission of one or several significant variables (Lee et al., 2000; Li et al., 2007).

The China's high savings puzzle inspired remarkable attention on the analysis of the topic in the country, which provides evidence in support of the contribution of dependency ratio to high savings rate during 1953 to 2000 (Modigliani and Cao, 2004). Li (2006) further posited that the high household savings rate played an essential and crucial role in the high national savings rate, which was due to the low dependency burden and high labour force proportion with households. With the adoption of the model used in Leff (1969), the significant negative impacts of child dependency ratio and old-age dependency ratio on savings rate were supported by evidence found in China's case (Wang et al., 2004). Some other studies found no evidence in support the negative relationship, as did in international analysis (Kraay, 2000; He, 2006; Wang, 2008). While these findings deepen our understanding of the association between population age structure and savings rate, more research on this topic is needed, as the incongruence of conclusions drawn in previous studies.

4.3 Research framework

Population is considered as one of the most powerful impetuses to economic growth in China, which has been explained by numerous economic and demographic theories and models. One of these is the demographic dividend theory, which postulates that a young population provides abundant labour force that can benefit the economy (Bloom and Williamson, 1998). Empirical

studies based on Chine's experiences reveal that a young population with declining dependency ratio would contribute 20–25% to the contemporary GDP growth in China during 1982-2000 (Wang et al., 2004; Bloom and Finlay, 2008), which is referred to as the first demographic dividend, or the traditional demographic dividend. Along with population ageing and prolonging life expectancy, the other demographic dividend is proposed, which is called the second demographic dividend (Lee and Mason, 2007). While the first demographic dividend is caused by a young population with abundant labour force, the second demographic dividend is created by the rising savings because people must save more during working-age period to deal with risks, demands and uncertainty that old ages would bring in the future (Mason and Lee, 2006; Wang and Mason, 2006; Wang, 2007; Mas 2007; Cai, 2010). While these assertions are highly plausible, the second demographic dividend is inadequately understood and needs further empirical and theoretical analysis.

Guided by the demographic dividend theory, the formulation of the analysis framework in the present study was completed, as shown in Figure 4.7, which aimed to examine the impact of population ageing on the savings rate in China in the past two decades, and to provide the insight of the probability that the second demographic dividend would emerge in the country. In previous studies, researchers mostly used the dependency ratio to measure population age structure, which is inadequate. In this study, both the old-age dependency ratio and the growth rate of the old population are employed in the analysis, as this allows the ageing process to be effectively measured. Further, other demographic factors, macro-economic factors, financial policy, social security system and urbanisation factors are also included in the model. As some of extant studies considered only a subset of those factors, this is a significant contribution to the extant knowledge in this field.

The urban income growth rate and *rural income growth rate* are included in the model, as income growth is closely associated with household savings (Ando and Modigliani, 1963; Loayza et al., 2000; Cai and Wang, 2004; Li and Yin, 2007). Because of China's dual socio-economic structure, *urbanisation* and *ratio of urban income to rural income* are also included into the model (Yuan et al., 1999; Kraay, 2000; Wan et al., 2006). *Per capita GDP growth rate* is also considered into analysis, as it is the most important index for measuring the country's economic growth (Leff, 1969; Mason, 1988), and one of the four fundamental factors in Ando-Brumberg-Houthakker-Modigliani Hypothesis (Ando and Modigliani, 1963). *Unemployment rate* reflects the economy's dynamism, which is closely associated with national income and savings. In China's traditional culture, one of saving's functions is to support the elderly (Wang, 2008); therefore, the *proportion of people participating in social endowment pension* serves as the index for measuring the social welfare system in the model (Feldstein, 1974).

The other macro-economic factors included in the model are government behaviour factors. As savings rate is always closely linked to *interest rate* (Rossi, 1989; Loayza et al., 2001; Yao; 2010), the variable is included in the model as well. Similarly, financial policy also exerts influence on savings, which is measured in the present study through *financial expenditure proportion* and *government tax proportion* (Yin et al., 2007). However, as China is not a closed economy, export and import activities are its important components, and are modelled via the *proportion of export and import to GDP* as a measure of economy's openness. In addition, the model also includes *CPI* to control for the effect of inflation.

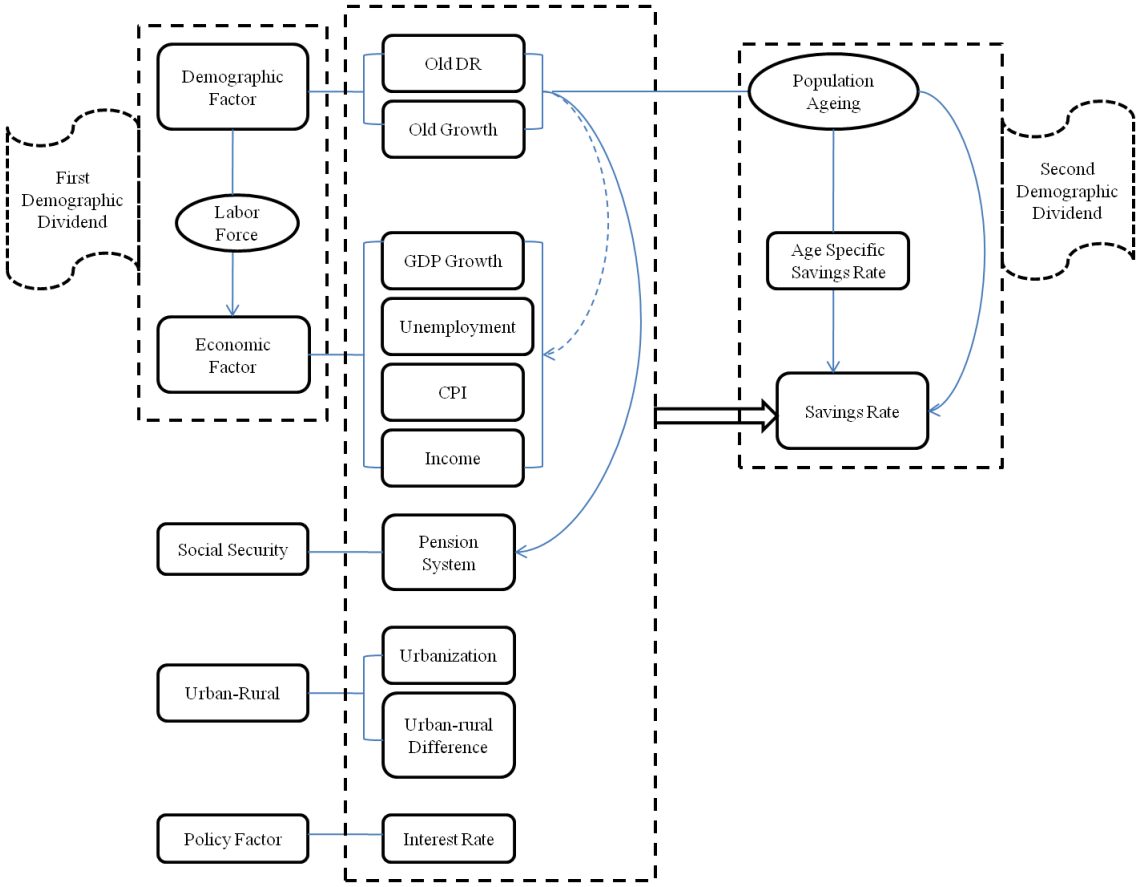

Figure 4. 7 Research framework

4.4 Ageing and household savings: Evidence from macro data

4.4.1 Data and method

The macro-level data used in this study is sourced from China Statistical Yearbooks that have been published by the National Bureau of Statistics in China during 1997–2010, China Compendium of Statistic 1949−2014 and the statistical yearbooks of each province during the period of 1997 to 2010. The data used in this research have been employed in some of the previous studies and have been shown to be suitable for measuring the savings rate and other indicators that are relevant to this study (Wang and Mason, 2005; Cai, 2010).

Based on the provincial panel data for the period of 1997−2010, the system GMM model was adopted for the analysis of examination in the effect of population ageing on savings rates

in China. The correlations between the explanatory variables and random error term indicate the problematic usage of traditional OLS models in consistent estimation of parameters (Mileva, 2007). Moreover, random effect models and fixed effect models also met difficulties in providing with unbiased estimations in a dynamic panel data, which are affected by the issues of unobserved heterogeneity and autocorrelations (Nerlove, 1971). In this context, the GMM model was developed, which allowed the lagged levels of the explained variable to be treated as the instrument variable for the endogenous issue (Arellano and Bond, 1991). However, this method has poor finite sample properties in terms of bias and precision as the lagged levels of the explained variable sometimes are weak predictors of the endogenous changes (Blundell and Bond, 1998; Bun and Windmeijer, 2009). The system GMM model was further developed with the usage of extra moment conditions that rely on certain stationarity conditions of the initial observations, which exhibited much better sample properties in terms of bias and root mean squared error (Blundell and Bond, 1998; Blundell et al., 2000). The lagged level of the explained variable, $SR_{i,t-1}$, was included in the analysis with endogeneity issue, which requires the appropriate adoption of the system GMM model.

In extant studies, savings rates were defined in various ways, such as national savings rate, public savings rate, household savings rate, private savings rate, etc. In this study, the savings rate pertains to the *household savings rate,* which better reflects individual savings behaviours, and is therefore more relevant for the delivery of the second demographic dividend. The dependent variable, *household savings rate*, is defined as the ratio of household savings to contemporary GDP (Li, 2010). The definitions of explanatory variables are presented in Table 4.1.

The model adopted in analysis is depicted by the following expression:

$$SR_{i,t} = \alpha_0 \cdot SR_{i,t-1} + \alpha_1 \cdot ODR_{i,t} + \alpha_2 \cdot OGR_{i,t} + \beta \cdot X_{i,t} + \lambda_t + \mu_i + \varepsilon_{i,t}$$

where $SR_{i,t}$ denotes savings rate of province i at time t; $ODR_{i,t}$ denotes the old-age dependent ratio of province i at time t; $OGR_{i,t}$ denotes the old population growth rate of province i at time t; $X_{i,t}$ denotes other controlling variables. λ_t denotes the unobserved time-varying fixed effect, which has no association with provinces. μ_i denotes the unobserved regional fixed effect, which has no association with time. $\varepsilon_{i,t}$ denotes the random error term. t demotes time. i denotes different provinces.

Table 4. 1 Variable definitions and descriptions

Variable	Definition	Mean	Std. Deviation
ODR	the old-age dependency ratio	11.45	2.53
OGR	the old people growth rate	2.96	9.02
GUI	the growth rate of urban disposable income	9.93	4.10
GRI	the growth rate of rural net income	9.26	12.57
URP	ratio of urban income to rural income	3.03	0.72
PGDP	the growth rate of per capita GDP	13.45	6.11
UR	unemployment rate	3.62	0.76
CPI	consumption price index	1.02	0.24
IR	interest rate	3.00	1.42
FEP	proportion of fiscal expenditure to GDP	17.79	13.06
GTP	proportion of government tax to GDP	6.04	2.42
RS	social endowment pension coverage rate	26.32	18.74
OPEN	net exports to GDP	3.91	5.19

Sources: Natioanl Bureau of Statistics, China Statistical Yearbooks 1997–2010, Beijing: China Statistics Press.

4.4.2 Multivariate analysis

In this section, the gross effects of old-age dependency ratio and elderly population growth rate on China's household savings rate are examined without controlling for other socio-economic variables, as shown in Table 4.2, including the estimation results using pooled OLS model,

Fixed Effect model and two-step system GMM model. Due to the existence of μ_i, the estimation of coefficient of $SR_{i,t-1}$ in the two-step system GMM model should be between those using pooled OLS model and Fixed Effect model (Nickell, 1981; Hsiao, 1986), as evidence in support with an efficient estimator. The model results support the usage of two-step system GMM model in the present study.

It is expected that the old-age dependency ratio would have a positive effect on the savings rate, as households need to save more to support their elderly parents in an ageing society. Based on the System GMM estimation results, the old-age dependency ratio indeed exerts a positive effect on household savings rate; however, the effect is statistically insignificant. Further, the growth rate of the old population presents a significantly negative and stronger effect on household savings.

Table 4. 2 Model results of ageing and savings

	OLS model	FE model	System GMM model
Lag_SR	0.936（0.0153）***	0.717（0.0323）***	0.925（0.0067）***
ODR	0.0001（0.0009）	-0.0034（0.0017）**	0.0002（0.0002）
OGR	0.0006（0.0003）**	0.0006（0.0003）**	-0.0006（0.0001）***
Constant	0.0488（0.0152）***	0.2382（0.0276）***	0.0583（0.0034）***

Note: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

To further investigate the relationship between ageing and the household savings rate, the two-step system GMM model was run while controlling for other explanatory variables to obtain the pure and robust effects of population ageing on savings rate in China.

The last column of Table 4.3 shows the final regression model results of the system GMM estimation. The model results show that old-age dependency ratio has a positive effect on

household savings rate in China, though statistically insignificant. In fact, old-age dependency ratio makes a complicated effect on the household savings rate, with the combination of negative effect from life cycle perspective and positive effect of legacy motivation. First, the social security system could substitute the precautionary savings for old-age life to some extent, with the crowding-out effect of 30-50% (Feldstein, 1974; He et al., 2008), which is also supported with evidence of a significant negative effect of social endowment pension on household savings rate in the model. The inadequately developed social pension system prompts the Chinese households to save more for supporting a longer old-age life and dealing with risks regarding old-age life as well. Second, on the contrary to the life cycle hypothesis, the legacy motivation plays an important role in affecting the savings, as well as consumption in old-age life (Kotlikoff et al., 1981), especially in China where people have close intergenerational relationships and intensive legacy motivations (Collins, 1991). In addition, the results might be affected by the analysed period, during which the old-age dependency ratio changed more slightly than child dependency ratio.

In addition to old-age dependency ratio, the growth rate of old population exerts a significant negative effect, which is much stronger than that of old-age dependency ratio. However, when compared with other socio-economic factors, demographic factors play a much smaller role, whereby the negative effect of population ageing is offset by the positive influence of other socio-economic factors, such as income growth.

Table 4. 3 GMM model results of ageing and savings

SR	System GMM (two step)											
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)
Lag_SR	0.0931***	0.939***	0.953***	0.987***	0.944***	0.969***	0.95***	0.95***	0.88***	0.947***	0.947***	0.94***
ODR	0.00092**	0.00075	0.0009	0.001**	0.0008*	0.0006	0.0007	0.001***	0.001	0.0006	0.0002	0.00007
OGR	-0.0001	-0.000026	-0.000051	-0.000011	-0.000053	-0.000052	-0.000036	-0.00013	-0.00001	-0.00013	-0.00008	-0.0003
GUI	-0.0016***											0.00089**
GRI		-0.0000007										0.000042
URP			0.00217									-0.005
PGDP				-0.002727***								0.0025***
UR					-0.00111							0.0028
CPI						-0.0768						0.162
IR							-1.08***					0.754***
FEP								0.0028****				0.00018
GTP									0.006***			0.005*
RS										-0.000003		-0.0005***
OPEN											0.00056	-0.0001
Cons	0.0386	0.0163	-0.00294	0.0312	0.0149	0.0759	2.524***	-0.0041	0.3426	0.011	0.139	1.65***
Obs.	403	403	403	403	403	403	403	403	403	403	403	403
Hansen Test	1.000	0.855	0.881	0.991	0.794	0.999	0.890	0.989	0.946	0.939	0.990	1.000
AB Test for AR2	0.116	0.112	0.108	0.185	0.108	0.107	0.107	0.119	0.134	0.120	0.120	0.186

Notes: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

4.5 Ageing and household savings: Evidence from micro data

4.5.1 Data and method

The macro-level data analysis suggests that population ageing, as measured by the old-age dependency ratio and the growth rate of old population, exerts significant effects on the aggregated household savings rate. However, the aggregated data cannot provide the explanation for the mechanisms through which the effect of ageing is manifested on household savings. To further explore the impact of ageing on savings at household-level, micro-level data from household surveys in China was used to discern the effects of ageing on savings within households.

The survey data used in this chapter are from the China Family Panel Studies (CFPS) survey in 2010. This survey is organised by the Institute of Social Science Survey (ISSS) at Peking University in China, and is a general-purpose, nationally representative, longitudinal survey of Chinese society. This survey focuses on the economic as well as noneconomic well-being of the Chinese population, gathering a wealth of information covering topics such as economic activities, educational outcomes, family dynamics and relationships, migration, and health (Xie and Hu, 2014). As a part of the survey, individual-, family-, and community-level longitudinal data is collected to provide comprehensive and objective data on Chinese society. So far, four waves of the survey (2010, 2011, 2012 and 2014) have been carried out, and the micro-level data employed in this study pertains to the 2010 wave, as a part of which more than 50,000 individuals and about 1,500 households were surveyed. The aim of this analysis is to explore the ageing within households and its effects on household saving behaviours.

Chinese society is a multilevel system, as individuals are embedded in larger social institutions, such as work units, communities, families, and governments (Xie, 2010). In this

nested structure, the family is the most direct and basic social institution that affects individual roles, status, behaviours, and attitudes, which is of primary importance. In addition, households or families sharing similar characteristics seem to reside in the same neighbours or communities. Moreover, China's society and economy present significant disparities among regions and provinces, which differ in the degree of economic and social development. Thus, when analysing the economic behaviours of Chinese households, it is essential to take multilevel variables into consideration. For the purpose of the present study, both Binary Logistic regression model and Hierarchical Linear Model (HLM) were employed to examine the effect of ageing on household savings behaviours, whereby the HLM model incudes variables at individual, family, community, and provincial level (Table 4.4)

4.5.2 Descriptive analysis

The aim of these analyses is to investigate the relationship between ageing and household saving behaviours at the micro level using the data from the China Family Panel Studies survey. The size of effective samples from the survey data is about 13,270 households after sample selection. Based on the micro-level data, it is possible to examine the age distribution of householders in the survey, which is presented in Figure 4.8, demonstrating that the average age of Chinese households was about 50 in 2010.

Table 4. 4 Variable definitions and descriptions

Variable	definitions	descriptions	Mean	Std. Dev.	Min	Max
saving	whether deposit money or not in last year	dummy variable, with the value 0 denoting "no" and value 1 denoting "yes"	0.38	0.48	0	1
savings	the amounts of bank balance for households at the end of last year	continuous variable	10082.42	48713.66	0	2,000,000
parent	whether having old parents aged 65 and above	dummy variable, with the value 0 denoting "no" and value 1 denoting "yes"	0.52	0.50	0	1
child0_14	whether having children aged 0-14	dummy variable, with the value 0 denoting "no" and value 1 denoting "yes"	0.27	0.44	0	1
hhsize	household size	continuous variable	3.78	1.73	1	26
faminc	total family income in last year	continuous variable	35314.32	52532.74	5	2,042,105
housing	what kind of housing the household living currently	category variable, with the value 1 denoting "self-owned", value 2 denoting "renting" and value 3 denoting "provided by others"	1.20	1	1	3
age	age of householders	continuous variable	50.32	12.91	16	97
hukou	registration status of householders	dummy variable, with the value 0 denoting "non-agricultural" and value 1 denoting "agricultural"	0.69	0.46	0	1
gender	gender of householders	dummy variable, with the value 0 denoting "female" and the value 1 denoting "male"	0.74	0.44	0	1
job	employed or not for householders	dummy variable, with the value 0 denoting "no" and value 1 denoting "yes"	0.78	0.42	0	1
marriage	the marital status of householder currently	category variable, with the value 1 denoting "unmarried", value 2 denoting "married" and value 3 denoting "divorced or widowed"	2.07	0.34	1	3
education	education attainments of householders	category variable, with the value 1 denoting "illiteracy or primary school", value 2 denoting "middle school", value 3 denoting "high school", and value 4 denoting "college and above"	1.81	0.93	1	4
gdpgrowth	the growth rate of each province	continuous variable	5.87	1.97	2.9	9.78
community	urban or rural communities the household living currently	dichotomous variable, with the value 1 denoting "urban" and value 2 denoting "rural"	1.66	0.47	1	2

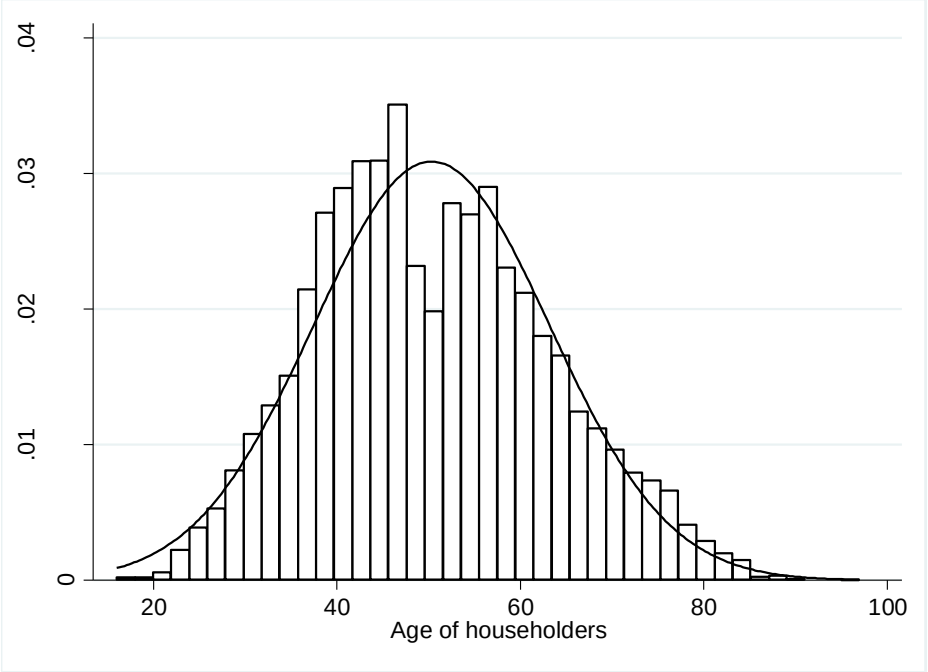

Figure 4. 8 Age distribution of householders in China, 2010

As a part of the survey, information pertaining to Chinese household savings in the previous year is collected, which provides database for analysing the household saving behaviours from the micro perspective. Based on the results, about 37.6% of the Chinese households (4,714) deposited money into banks in 2010, about 10,082 *yuan* on average. If only the households that had saved money in previous years are analysed, the average savings of Chinese households increase to about 27,165 *yuan* (Table 4.5). The distribution of household savings is skewed, indicating that a small number of households have higher savings.

Table 4. 5 Household savings descriptions, 2010 (*yuan*)

	N	Mean	Std. Dev.	Lower percentile	Median	Upper percentile
Household savings	4,714	27,165	77,009	4,000	10,000	25,000

Notes: The table is based on the household samples that had deposited money in the bank in the previous year.

4.5.3 Bivariate analysis

In the next phase of analysis, the relationships between household savings (having/not having savings, and the amount of household savings) and relevant explanatory variables were examined, including the age of householders, having/not having old parents, and having/not having children aged 0−14. The bivariate analysis between household savings and age of householders suggests that the age of householders exerts a negative effect on household savings (Figure 4.9). In households with younger householders (aged below 40), the proportion of those that had savings was the highest, and was about 46.3% in 2010 (Table 4.6). As the householder age increases, the proportion of those that deposited money in the preceding year declines. For example, only 33% of the households with members older than 65 deposited money into banks in 2010, which is about 13% lower than the percentage of households with younger householders.

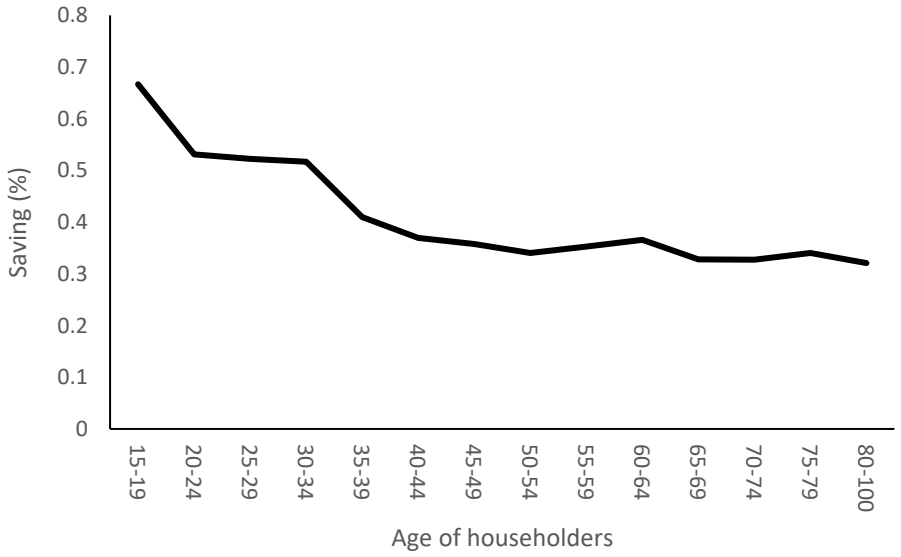

Figure 4. 9 Whether deposited money or not and age of householders in China, 2010

Notes: Age of householders is defined as the age of the head of household, which is a continuous variable.

The average amounts of household savings are negatively affected by householder ages as well. In households with younger householders (aged below 40), the average amount of household savings was about 12,524 *yuan* in 2010. In households with older householders, the average amount of household savings was much lower, i.e., 9,422 *yuan* in households with householders aged 40−64 and 9,396 *yuan* in households with householders aged 65 and above. The bivariate analysis indicates that the householder age exhibits a stronger relationship with having savings or not than with the amounts of household savings.

Table 4. 6 Household savings and age of householders, 2010

Age of householders	Proportion of saving in last year	Household Savings (*yuan*)
<40	0.4630	12,524
40-64	0.3574	9,422
65+	0.3294	9,396
Correlation coef.	-0.088***	-0.022**

Notes: ** denotes significant at 5% level; *** denotes significant at 1% level.

Having elderly parents (aged 65 and above) also exerts significant effects on household savings. Only 33.5% of Chinese households without elderly parents have savings, compared to 38.8% of households that include old parents. The amounts of household savings present the same relationship.

Table 4. 7 Household savings and supporting elderly parents, 2010

Having old parents aged 65+	Proportion of saving in last year	Household Savings (*yuan*)
No	0.335	8,922
Yes	0.388	10,496
Correlation coef.	0.055***	0.017*

Notes: * denotes significant at 10% level; *** denotes significant at 1% level.

In China, rearing children aged 0−14 affects the household savings as well, which tend to increase the probability to save. The probable explanation for this is that the Chinese parents prefer to save money for their children's education. However, there is no statistically significant relationship between raising young children and the amount of household savings.

Table 4. 8 Household savings and raising children, 2010

Having children aged 0-14	Proportion of saving in last year	Household savings (*yuan*)
No	0.365	10,131
Yes	0.406	9,952
Correlation coef.	0.0384***	-0.0016

Notes: *** denotes significant at 1% level.

4.5.4 *Multivariate analysis*

To further examine the effect of population ageing on household saving behaviours, a Binary Logistic regression model was developed, as shown in Table 4.9. Based on the model results, the relationship between the householder age and savings keeps unchanged after including all control variables into the model, which indicates that the impact of ageing on household savings is the product of interactions among different variables. More specifically, the age of household has a slightly negative relationship with the probability of saving money in all household samples. Supporting elderly parents also exerts a positive influence with the aforementioned probability, in consistence with macro-level analysis; however, the relationship is not statistically significant. In Chinese households with elderly mothers, the age and education attainment of elderly mothers would significantly affect the probability of saving money for the household. Specifically, when the oldest parent is aged 85 and above, this would increase the probability of saving, which is mainly due to the uncertainty regarding the poorer health and

greater care demands of elderly mothers. If the elderly mother has attained college education and above, which signifies higher social and economic status, the probability of saving money for the whole household would decline by 14%. In addition, it needs to be particularly noted that raising a child aged 0−14 would significantly increase the probability of saving money for the Chinese households, which is statistically significant at 1% level.

Table 4. 9 Binary Logistic regress results of ageing and household savings

Deposit money or not in last year	All households		Households with old mother	
	Odds Ratio	Std. Err	Odds Ratio	Std. Err
age of householder	0.977	0.003**	0.986	0.009
Having old parents (Ref. No)				
Yes	1.017	0.055		
Age of mother (Ref. <64)				
65-85			0.943	0.005***
85+			1.182	0.020***
Education of mother (Ref. Primary sch.)				
Middle sch.			1.290	0.017***
High sch.			1.267	0.231
College and above			0.864	0.191
Having young children (Ref. no)				
Yes	1.196	0.082***	1.137	0.024***
household size	0.877	0.014***	0.844	0.002***
Log (income)	1.978	0.058***	2.035	0.082***
Housing (Ref. Self-owned)				
Rent	1.232	0.130**	1.203	0.124*
Living in others' house	0.858	0.087	1.080	0.031***
Hukou (Ref. Non-agriculture)				
Agriculture	0.788	0.046***	0.787	0.056***
Gender (Ref. Female)				
Male	1.076	0.061	1.088	0.160
Marriage (Ref. Unmarried)				
Married	1.348	0.282	1.095	0.141
Divorced/widowed	1.040	0.232	0.730	0.124*
Education (Ref. Primary sch.)				
Middle sch.	1.391	0.076***	1.449	0.214**
High sch.	1.715	0.123***	1.779	0.174***
College and above	2.681	0.300***	2.600	0.631***
Employment (Ref. unemployed)				
Employed	1.033	0.063	1.091	0.240
Constant	0.000	0.000***	0.001	0.001***

Notes: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

Household size and family income would significantly affect the household savings as well, with smaller households and high-income households being more likely to have savings. For the Chinese households, housing also plays an important role in the decision to deposit money or not. The model results suggest that households who rent their accommodation are 23% more likely to save money than those who own their residence. On the other hand, those living in accommodation provided by other family members (parents, children or other relatives) are less likely to save money.

The demographic and socio-economic characteristics of householders would significantly affect the household saving behaviours as well. Compared with urban households, Chinese rural households are 21% less likely to save money. However, the probability of saving money is much higher for the households with highly educated householders.

In addition to the analyses reported above, the Hierarchical Linear Model (HLM) was developed using the amounts of household savings as dependent variable to examine the effects of ageing within households. The model results show that the age of householders exhibits a negative relationship with the amount of household savings in all household samples, which is statistically significant. Having elderly parents within households would reduce the household savings, which is statistically significant at 5% level. In addition, raising a child aged 0−14 would significantly increase the household savings, as parents wish to save for their children's education in the future. Smaller households tend to have larger amounts of savings, and households with high income also have more savings in China. However, housing plays an important role in household savings, whereby Chinese households that live in rented accommodation have larger savings, which is designated for property purchase in the future.

In those Chinese households with elderly mothers, mother's age and education attainment

affect the household savings as well. In the selected samples, the age of household has a negative association with the amount of household savings, which is, however, statistically insignificant. The households with mothers aged 65−85 have significantly less household savings compared to those living with old mother aged 85 and above.

Table 4. 10 Hierarchical Linear Model results of ageing and household savings

	All households		Households with old mother	
	Coef.	Std. Err.	Coef.	Std. Err.
age of householder	-0.013	0.006**	-0.015	0.016
Having old parents (Ref. No)				
Yes	-0.202	0.101**		
Age of mother (Ref. <64)				
65-85			-0.288	0.146**
85+			0.264	0.199
Education of mother (Ref. Primary sch.)				
Middle sch.			0.401	0.189**
High sch.			0.189	0.321
College and above			-0.480	0.733
Having 0-14 children (Ref. no)				
Yes	0.211	0.127*	0.188	0.196
household size	-0.233	0.029***	-0.315	0.048***
Log (income)	1.013	0.048***	1.192	0.115***
Housing (Ref. Self-owned)				
Rent	0.210	0.220	0.307	0.392
Living in others' house	-0.316	0.178*	0.142	0.255
Hukou (Ref. Non-agriculture)				
Agriculture	-0.520	0.136***	-0.454	0.270*
Gender (Ref. Female)				
Male	0.279	0.107***	0.179	0.139
Marriage (Ref. Unmarried)				
Married	0.315	0.327	0.199	0.445
Divorced/widowed	-0.166	0.350	-0.519	0.366
Education (Ref. Primary sch.)				
Middle sch.	0.512	0.103***	0.561	0.129***
High sch.	0.759	0.141***	0.708	0.187***
College and above	2.119	0.214***	1.935	0.381***
Employment (Ref. unemployed)				
Employed	-0.009	0.120	0.349	0.208*
Constant	-6.983	0.659***	-7.293	1.618***

Notes: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

Many other individual characteristics of householders affect the household savings as well. For example, in China, rural households have less savings than urban households, which is statistically significant at 1% level. Households with a male householder tend to have greater savings. Similarly, in those households with highly educated householders, the amounts of savings are much greater, especially in those with householders having college degree and above.

4.6 Second demographic dividend: Some discussions

The first demographic dividend is proposed to explain the contribution of the abundance of cheap labour force to economic growth. In the demographic transition process of a given population, young population age structure with declining dependency burden would generate a powerful driving force for economic growth, which usually lasts for decades (Bloom and Williamson, 1998). However, once the country has completed demographic transition, the growth of working-age population would slow down relative to that of the old population, due to which the first demographic dividend will diminish, which is argued to be presently occurring in China (Wang, 2007; Cai, 2010). In this context, due to population ageing and longer life expectancy, the other kind of demographic dividend is proposed, which is called the second demographic dividend (Lee and Mason, 2006). The second demographic dividend arises because changes in age structure influence the processes that lead to the creation of wealth through two mechanisms. In East Asia, it is posited that population ageing will lead to rapid capital accumulation as a result of working-age population increasing their savings prior to retirement in order to mitigate the uncertainties and demands of old-age life (Mason and Lee, 2006; Wang and Mason, 2006; Cai, 2010). The other possibility is that population ageing will produce an increase in intergenerational wealth transfer. In other words, wealth will transfer

from working-age population to the elderly through social pension system or family support. This kind of wealth transfer can effectively redistribute wealth and income across age groups, but it could not create capital and is often subject to taxation (Wang and Mason, 2006).

In this chapter, the relationship between population ageing and household savings rate was investigated, whereby the findings yielded by evidence-based analysis revealed the likelihood of Chinese citizens realising the second demographic dividend in the future. Some scholars argue that the second demographic dividend might have a much more powerful effect on economic growth when compared with the first demographic dividend (Mason, 2005). In their view, longer life expectancy serves as a strong motivation for saving more in preparation for old age. However, the findings yielded by this study seem to counter this assumption.

The Chinese have always had a strong desire to save money, due to which the country presently has the highest savings rate worldwide (Chen et al., 1999; Peng, 2006; Li and Yin, 2007; Ai, 2008; Su and Liao, 2010). Over the last three decades, the Chinese economy has been experiencing rapid growth, which was reflected in increased income for the Chinese people. As a result, given the cultural preference for savings, this additional income was mostly used to increase household savings, which are argued to be designated for children's education, housing purchase, and supporting old parents (Ai, 2008). In addition, the inequality in primary and secondary distribution of national income account, increasing costs of children's education, rising housing prices, and uncertainties regarding income in the future further reduce the propensity to consume and prompt the Chinese households to save money. However, the changing demographic conditions would produce unprecedented implications on the savings rate in the country.

China has become an ageing society at the beginning of the twenty-first century, making

it a suitable case study of the second demographic dividend effects. In the present study, this topic was explored by analysing the relationship between population ageing and household savings from both macro and micro perspective. Based on the quantitative analysis results, the old-age dependency ratio shows a slight and positive relationship, though statistically insignificant, with household savings rate at the macro level. It seems to indicate that the increasing dependency burden of supporting the elderly would probably increase the household savings. However, the elderly population growth rate exerts a negative and stronger effect on household savings rate, which is statistically significant. This macro-level analysis implies that a negative effect of population ageing on household savings rate is expected during the period in which old population grows at an accelerated rate. Furthermore, the analyses conducted as a part of this investigation allowed examining the association between ageing and household savings using micro-level data. This approach enhances the understanding of the mechanisms through which ageing affects household savings. The findings suggest that having elderly parents within households could increase the likelihood that the household will save money; however, it would significantly reduce the amounts of savings. Moreover, the age of householders would negatively affect the probability and amount of household savings in China. The empirical analysis based on China's experiences thus does not support the theoretical mechanisms of realising the second demographic dividend.

Over the past 15 years, the negative effect of ageing on household savings was fully countered by the positive effects of other socio-economic factors, which explains the mechanism behind China's rising savings rate despite having an ageing population. However, in the future, the country will be confronted with an accelerating population ageing, both in size and proportion. In the next three decades, the number of elderly individuals (those aged 65 and

above) in China would further increase to more than 300 million (equivalent to almost the entire population of the USA in 2014). Given this background, it can be expected that the population ageing process would generate an increasingly negative effect on the household savings, which additionally challenges the realisation of the second demographic dividend in China from the demographic perspective.

In the future, as the working-age population ages, they will face a much tougher situation than their parents presently do. First, households are bearing a much heavier dependency burden due to the need to support their elderly parents with a growing old-age dependency ratio. Second, the rapidly increasing housing prices would reduce the average propensity to consume and will compromise wellbeing of the Chinese households. Third, the sustainability of Chinese economy is challenged by changing demographic conditions, rising labour costs, increasing dependency burden, and more competitive international environment, which indicates the economic slow-down in China. Thus, combined with the quantitative analysis findings, the results reported in this chapter suggest that the expected second demographic dividend in China will be very difficult to realise. The Chinese government must implement political and economic reforms to boost country's socio-economic development in the future, including restructuring the income distribution, breaking the rural-urban barriers in social welfare system, and transiting its economy, instead of relying on the very uncertain second demographic dividend.

4.7 Conclusions

The importance of population structure in household savings decisions has long been recognised by researchers and policy makers, especially given the rapid and prevalent population ageing that occurred in the second half of the twentieth century. China has achieved a great miracle in its economic development, mostly due to large investments resulting from

the rising savings rates in the past three decades, at the time when the country went through a rapid demographic transition process. This provides a good case to study the effect of changes in population age structure on savings rate. China's high savings rate is due to its rapid economic growth, driven by the traditional and cultural factors affecting the Chinese saving and expenditure behaviours, despite the drastic changes in the demographic environment.

This study highlights the effect of demographic factors on the household savings rate in China. First, the findings revealed that the growth rate of the old population exerts a significant and negative effect on the household savings rate. After controlling for other socio-economic factors, the growth rate of the elderly population was negatively related with the household savings rate in China during the past few decades. Due to the slow ageing process in that period, ageing had a negligible effect on the household savings rate. However, by 2025, there will be more than 200 million individuals aged 65 and older, corresponding to 14% of the total population. The ageing process in China will accelerate in terms of both size and speed and will have different spatial effects. In other words, the growth rate of the old population will exert a more powerful negative effect on household savings rate in the future, making the realisation of the second demographic dividends in China highly unlikely. This is also supported with evidence found in micro-level analysis of the present study, the age of householder presents negative associations with the probability of household savings, as well as the amount of household savings. It indicates that the Chinese household savings would be decreasing, along with an ageing population.

Second, the old-age dependency ratio exhibits a slight positive effect on household savings rate after controlling for other socio-economic factors, even though this effect is statistically insignificant. This finding indicates the weakness and limitation of life cycle theory in

explaining the Chinese savings behaviours. Extant studies in this field provide evidence supporting the explanatory power of the life cycle theory, which is typically obtained by analysing the effects of fertility decline or the child dependency ratio decline or old-age dependency ratio on the savings rate (Mason, 1998; Horioka and Wan, 2007; Banerjee et al., 2010). However, the quantitative analysis conducted as a part of the present study yielded findings that counter the existence of a relationship between the old-age dependency ratio and household savings rate under the life cycle framework in China's case. This might be due to the slight changes in the old-age dependency ratio in the past decades. However, it is more likely that this discrepancy is due to the Chinese traditional and cultural characteristics, whereby adult children feel obligated to support their elderly parents and parents transfer wealth to children through bequests.

Third, social endowment system plays a significant role in the households' savings behaviours. Based on the quantitative analysis results, the coverage ratio of social endowment insurance system has a significant negative effect on the household savings rate in China. This result indicates that poorly developed social endowment system would inspire households to save more due to precautionary saving motives, bequest motives and consumption behaviours in old-age life. This finding further suggests that the government’s and societal contributions to the social pension system that benefits the rapidly ageing population would affect the households’ savings behaviours and would increase the savings rate.

The evidence demonstrated in this study supports the view that population ageing has a significant and negative effect on China's household savings, though a positive effect of supporting old parents on household savings rate. Population ageing affects household savings rate through two paths, as it positively affects the household savings rate through the old-age

dependency ratio and supporting old parents, while negatively affecting China's household savings rate via the old population growth rate and ageing householders. Comparatively, the old population growth rate exerts a much stronger and more significant effect. In addition, supporting the old parents would decrease the amount of household savings. China became an ageing society at the turn of the twenty-first century, and this ageing process will accelerate both in size and speed in the next three decades. According to UN's newest population projections, the Chinese population would meet the declining trend after 2030s, while, with continuously growing old population until 2060 (UN, 20117). With the projection results, the proportion of the elderly aged 65 and above would rise to 30% after 2060s (UN, 2017). Population ageing will thus play an increasingly important and long-term role in China's society and economy. Considering the accelerated population ageing process and the rapidly growing old population in China, population ageing would exhibit a stronger negative effect on China's household savings rate in the future. The second demographic dividend is proposed in the context of population ageing, but in the long-term run, the continuously growing old population would heavily increase the burden of supporting the elderly upon households, governments and social pension system, it would therefore interfere with the realisation of the second demographic dividend.

The Chinese economic growth largely depends on the substantial amount of investments in past three to four decades, especially in public infrastructure and large construction projects (NDRC, 2010; Wang, 2013), which are sourced from the high savings rate. The rapid ageing process would challenge the household savings through both the increasing old age dependency ratio and the heavy burden of supporting the elderly, which would therefore affect the available social investments. The findings from this study provide evidence-base analyses on the impacts

of population aging on household savings, which informs the policy formulation in dealing with the challenges in economic growth associated with ageing of population and labour force in the future.

Moreover, the findings of significant effects of social endowment system on household savings reveal the importance of developing social security on supporting old parents. In traditional culture of China, supporting old parents is mainly regarded as the responsibility of families, instead of the governments, which would definitely affect the economic behaviours within households, especially in the rapid ageing process. The analysis presented in this chapter suggests the significance of social pension system in supporting the elderly and influencing household savings.

Chapter 5 Do Older People Consume More? Impact of Ageing on Household Consumptions in China

5.1 Introduction

The Chinese economy has made great achievements in recent decades, regarded as the fastest economic growth globally, which has attracted worldwide attention (Lin et al., 1999; Cai, 2006). This economic miracle has significantly improved the living standards in China, which presently has one-fifth of the world population. Thereby, the country's progress has some profound implications for the world economy (Guo, 2008). The great success of the Chinese economy is largely due to its economic and political reforms, demographic dividend and abundant government-led investments (Bloom and Williamson, 1998; Cai and Wang, 1999; Wang et al., 2004; Lai et al., 2005; Cai, 2010). However, China has recently faced with some challenges in its economic growth, which would threaten and weaken the economy's sustainability in the future, including issues of structural imbalance in the economy, income distribution inequality, undeveloped social welfare system, and forthcoming demographic challenges. Among all those factors that are posited to hinder the economic growth, the decreasing domestic consumption rate is the cause of the greatest concern for the country, especially under the economic transition from investment-oriented to consumption-oriented economy.

The issue of decreasing domestic consumption rates has been a source of concern and has attracted attention of both academics and governments. Previous studies on this issue have launched heated debates and discussions about China's declining domestic consumption rates (Liu, 1999, 2010; Xu, 2005; Li et al., 2008; Chen and Chen, 2009). Scholars argue that the high savings rates and inequality in primary and secondary distribution of national income accounts,

decreasing average propensity to consume, uncertainty regarding income in the future, and the widening gap between rural and urban households have resulted in the declining household consumption rate in China (Liu, 1999, 2000; Wang, 2002; Xu and Li, 2005; Li and Yin, 2007; Lin, 2007; Zhang, 2009; Chen, 2012). At the same time, extensive investments, which has been the largest source for economic growth in the past several decades, limit the domestic consumption to some extent, leading to a decreasing domestic consumption rate in China (Fang, 2009; Yuan and Yang, 2008; Cai and Wang, 2010). In addition, the successive Chinese governments have implemented numerous institutional, economic and political reforms since the end of the 20th century, including institutional reforms in the housing market, education system, medical system and social welfare system, which transfer the burden from governments to households and individuals. To deal with uncertainties regarding income in the future, raise young children and support the old-age life, the Chinese households must increase precautionary savings, which would result in diminishing the average propensity to consume, leading to declining household consumption rates (Campbell and Mankiw, 1991; Guo, 2007; Yang and Chen, 2009; Wang and Xu, 2010; Luo, 2010; Hang, 2010). Moreover, the primary and secondary distribution of the national income among government sectors, enterprises and households has been rapidly changing in the last two decades, leading to a gradual decrease in the proportion of household incomes in the national income account since the 1992 levels, which further caused the decline in household consumption rates (Li and Yin, 2007; Zhang, 2009). The disparity in income growth and the inequality in income distribution between rural and urban areas also play important roles in the decreasing household consumption rates in China. The income gap between the rural and urban households in China exerts a significant negative effect on household consumption (Liu, 2000; Yuan and Zhu, 2002; Lou and Li, 2009;

Wu et al., 2010). Specifically, the growing income disparity between rural and urban areas during 1985−2004 has caused a decline in the average propensity to consume in China, especially in the long run (Wu and Wu, 2007). It has been argued that the growing income gap between rural and urban households has also led to a decrease in the overall social propensity to consume (Zeng and Hu, 2008; Yang and Liu, 2008). According to the latest statistical report published by National Bureau of Statistics of China, the rapidly growing income disparity is reflected in the growing Gini coefficient, which increased from 0.12 in 1978 to 0.462 in 2015 (NBS, 2016). Other researchers have taken the public expenditure into consideration when analysing the low domestic consumption rates in China. Studies based on western countries' experiences show that government expenditure also exerts significant effects on household consumption (Barro, 1981; Ho, 2001; Schclarek, 2007). In China, government expenditure, which has retained the same proportion in the final consumption expenditure, diminishes household consumption expenditure to some extent (Chen et al., 2008; Chu and Lu, 2008). On the other hand, according to Shen and Ma (2007) and Zhang and Wu (2007), evidence-based analysis results indicate that the influence of government consumption expenditure on household consumption expenditure might differ depending on the public expenditure categories.

Authors of previous studies focusing on the long-term decline in the domestic consumption rates in China also discuss the changes and challenges facing the economy in the future. However, extant research tends to mainly focus on the obstacles probably brought out by the economic development strategy with great dependence on large amounts of investments and exports (Liu, 2000; Zhu et al., 2002). It has been argued that the Chinese government should implement reforms to boost its domestic consumption for sustainable economic growth,

considering the unfeasibility of increasingly growing investments and exports without adequate domestic consumption in the future (Krugman, 1994; Chang, 2006). Moreover, maintaining the current economic development strategy would undoubtedly cause structural discrepancy between large amounts of investments with low efficiency and growing demands for resources and energy (Wang and Pan, 2014). Consequently, the declining domestic consumption rates would challenge the sustainability of economic growth in the future (Zhang, 2009; Yang et al., 2011). In addition, the declining domestic consumption rates would increase the systematic risks of the financial system in China (Shen and Qi, 2007; Gu, 2011; Wang and Pan, 2014). In this context, investigating the Chinese household consumption rates and related influential factors is of growing significance and importance.

In addition to economic analysis focusing on the declining consumption rates in China, some researchers have particularly examined the effects of demographic changes on consumption (Erlandsen and Nymoen, 2008; Li et al., 2008; Chen, 2009; Hang and Guo, 2009; Kang, 2009; Hock and Weil, 2011). In the significant body of pertinent studies, two classical and fundamental theories were typically used as the theoretical framework for explaining the impacts of population age structure on consumption, namely the life cycle theory proposed by Modigliani in 1954, and overlapping generations model proposed by Samuelson and Diamond (Modigliani and Brumberg, 1954; Samuelson, 1958; Diamond, 1965; Neher, 1971). The life-cycle hypothesis strives to explain the consumption patterns of individuals under the life cycle perspective. The model suggests that individuals would rationally plan their consumption and savings behaviour over their life-cycle, intending to even out their consumption in the best possible manner over their entire lifetimes. While, the overlapping generations model explicitly describes income, consumptions, and savings during different periods of life, which is the

natural framework to study the allocation of resources across different generations. Compared to the life cycle theory, the overlapping generations model could take the intergenerational influences into consideration.

The effects of population ageing initially occurred in developed countries but now evident in many developing countries, scholars have attempted to establish the relationship between population age structure and consumption from both theoretical and empirical perspective (Heien, 1972; Hurd, 1990; Carroll and Summers, 1991; Fair and Dominguez, 1991; Haque et al., 1999; Weil, 1999; Cannon, 2003; Hock and Weil, 2006; Erlandsen and Nymoen, 2008). Authors of early studies in this field focused on the relationship between age structure and consumption rate using cross-sectional data, without reaching consistent conclusions (Leff, 1969; Mason, 1981; Mason, 1987). Culter et al. (1990) examined responses of investment, consumption, savings and productivity to population ageing in developed countries, concluding that population ageing might not result in savings reduction. Studies conducted in Australia and Canada, which underwent similar demographic and economic changes in the last century, also provide no evidence in support of the positive effect of age structure on consumption (Wilson, 2000). However, many other researchers, such as Loayza et al. (2000), Sarantis and Stewart (2001), Schrooten and Stephan (2005), and Hondroyiannis (2006), hold the opposite viewpoint, claiming that the population age structure exerts significant effects on consumption. The diametrically opposite conclusions drawn from studies using macro-level data are likely due to the quality of the data used for analysis and the differences in methodology adopted in these studies (Li et al., 2008). In analyses using micro-level data sourced from household surveys, the omission of intergenerational wealth transfer, measurement errors in data collection, and ensuing sampling selection bias would also result in inconsistent conclusions (Weil, 1994;

Demery and Duck, 2006; Li et al., 2008).

Focusing on related studies in China's case, it is meaningful to investigate the relationship between population and consumptions, considering the rapid demographic transition and low domestic consumption rate in the country. China became an ageing society at the turn of the twenty-first century, and its old population continues to grow (NBS, 2002). Based on the latest statistical report published by the National Bureau of Statistics of China, the number of individuals aged 65 and above has reached 14.4 million, contributing to the total population by 10.5% (NBS, 2016). In the near future, the county will be confronted with the rapidly aging population, as the large cohorts born in the 1960s and the 1970s will start entering old age. The rapid population ageing would have unprecedented and profound implications for the economy and society in China, one of which is the impacts of ageing on household consumptions. As the life cycle theory and overlapping generations model discussed, individuals present different consumption patterns over their lifetimes, which suggests that changes in population age structure would definitely affect aggregated consumptions (Li and Zhang, 2009). In China's case, the rapid population ageing process would make significant effects on its domestic consumption rates as well (Li, 2001). Analyses using panel data for the 1953−2000 period confirm presence of a positive influence of changes in dependency ratios on the high savings rate in the country (Modigliani and Cao, 2004). In addition, governments and families transfer the income from working-age population to dependent population through savings, household consumption and public expenditure (Canning, 2007). The social welfare system is relatively undeveloped in China when compared to that in place in Western countries, due to which Chinese households tend to save more for raising young children and supporting the elderly. Considering the rapid population ageing process and traditional culture in China, the average

propensity to consume, which has never been high, has recently started to decline (Li, 2010). Moreover, population ageing would also affect consumption level, size and pattern (Wang and Fu, 2006). Old-age dependency ratio exerts a significant negative effect on household consumption (Li and Zhang, 2009). This finding confirms that changes in population age structure would inevitably affect household consumption amounts and patterns in China. Furthermore, the rapidly growing old population would place a much higher demand on medical services compared to their need for other goods or service consumption (Xu, 2007; Zha and Zhou, 2011), indicating that population ageing would also affect the household consumption structure.

The Chinese economy has undergone transition from being largely dependent on labour-intensive industries and abundance of investments to being primarily consumption-oriented. However, at the same time, China is facing declining consumption rates and a rapid population ageing, which would greatly challenge the outcome of economic reforms in the country. Given this background, it is of growing significance to investigate the impact of population ageing on household consumption in the future, both in level and structure. The aim of the present study was thus to seek explanations and answers for the following questions: What is the relationship between population ageing and household consumption in China? To what extent does the rapid population ageing affect the household consumption? What changes would take place in the household consumption structure due to the accelerating ageing process in China? These questions are addressed from both macro and micro perspective, aiming to provide support and evidence at both national and household level.

5.2 Ageing and household consumptions in China

5.2.1 Population ageing in China

China experienced a rapid demographic transition process from early the 1970s to the 1990s, for which European countries required more than one hundred years (Chen, 2008; Liu et al., 2012). Over the period, the Chinese population accomplished the historical demographic transition, from a pre-modern regime of high fertility and high mortality to a post-modern one in which both rates are low (Li, 2000). The rapid demographic transition process, characterised by a fast decline in both fertility and mortality rates, brings drastic changes in its population age structure, with the demographic shift from a young population to a mature one.

In 2000, the share of the elderly (those aged 65 and above) exceeded 7% of the whole population, indicating that China has started to enter the ageing society (NBS, 2002). Specifically, the country has been experiencing increases both in size and proportion of the elderly population since the 1960s (NBS, 1985). In addition, the Chinese population is undergoing an increasing old-age dependency ratio as well, which increased from 8.35% in 1990 to 11.98% in 2010.

The population ageing process that has been taking place in the country occurred in each province with varying rate and speed during the period of 1990–2010 (as seen in Table 5.1). In most provinces, the old-age dependency ratio increased by more than 50% from 1990 to 2010, while in Sichuan, Gansu, Qinghai and Heilongjiang, the increase exceeded 80%. Although labour force migration relieves or intensifies the ageing situation in different provinces, in the country as a whole, population ageing is accelerating both in size and speed and will continue to accelerate in the future. The number of individuals aged 65 and older will exceed 200 million in 2025, and will account for about 14.2% of the whole population. In 2037, this number will

exceed 300 million, equivalent to 21.8% of the total population. Furthermore, 25% of the population will comprise of the elderly in 2050, with size of 329 million. The next three decades are the period during which China's population ageing will accelerate both in size and percentage, which will produce unprecedented challenges and opportunities for the society and economy in the country (Zuo; 2001; Cai et al., 2004; Lu, 2007; Sun and Zhu, 2008).

Table 5. 1 Old age dependency ration in China, 1990, 2000 and 2010

Region	1990	2000	2010	Region	1990	2000	2010
Chongqing	-	11.42	16.45	Hebei	8.92	10.04	10.99
Sichuan	8.03	10.83	15.19	Jiangxi	8.06	9.24	10.78
Jiangsu	9.78	12.36	14.30	Yunnan	7.72	8.96	10.64
Anhui	8.16	11.35	14.20	Beijing	8.64	10.80	10.54
Hunan	8.42	10.61	13.46	Jilin	6.52	8.05	10.53
Guangxi	8.85	10.98	13.38	Tianjin	9.13	11.24	10.43
Shandong	9.23	11.43	13.23	Heilongjiang	5.43	7.36	10.38
Guizhou	7.35	9.34	13.19	Fujian	7.99	9.51	10.30
Liaoning	7.99	10.59	13.17	Shanxi	8.11	9.32	10.06
Shanghai	12.96	15.02	12.46	Nei Mongol	5.93	7.52	9.65
Zhejiang	9.77	12.22	12.05	Guangdong	9.24	8.85	8.90
Henan	8.99	10.60	11.83	Xinjiang	6.20	6.86	8.87
Hubei	8.33	9.07	11.80	Ningxia	5.59	6.66	8.85
Hainan	8.79	10.24	11.18	Qinghai	4.64	6.65	8.66
Gansu	5.98	7.67	11.18	Xizang	7.74	7.42	7.22
Shaanxi	7.81	8.93	11.11	China	8.35	10.15	11.98

Sources: Population Census Office under the State Council, and Department of Population Statistics at National Bureau of Statistics. 1992. Tabulation on the 1990 Population Census of the People's Republic of China. Beijing: China Statistics Press; Population Census Office under the State Council, Department of Social Science and Technique Statistics at National Bureau of Statistics. 2002. Tabulation on the 2000 Population Census of the People's Republic of China. Beijing: China Statistics Press; Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

5.2.2 Changes in household consumption rates

China has been experiencing declining domestic consumption rates over the past several decades. Since the 1980s, China's domestic consumption rate (the proportion of domestic consumption in the contemporary GDP) has been declining continuously, from 61.4% in 1978 to 50.7% in 2015 (NBS, 2016). In fact, before 1991, China's domestic consumption rate remained above 60%, but started to decline, especially after 2000 (NBS, 2016). Data also show that China has experienced a widening gap with other countries in the final consumption rates in the recent decades. As shown in Figure 5.1, the final consumption rates in Japan increased form 59.9% in 1970 to 79.0% in 2015, while a reverse trend was noted for China. In the United States and Australia, the final consumption rates increased slightly in the same period. As the final consumption rate in China has been decreasing significantly, this negative trend contributes to the widening gap relative to other countries.

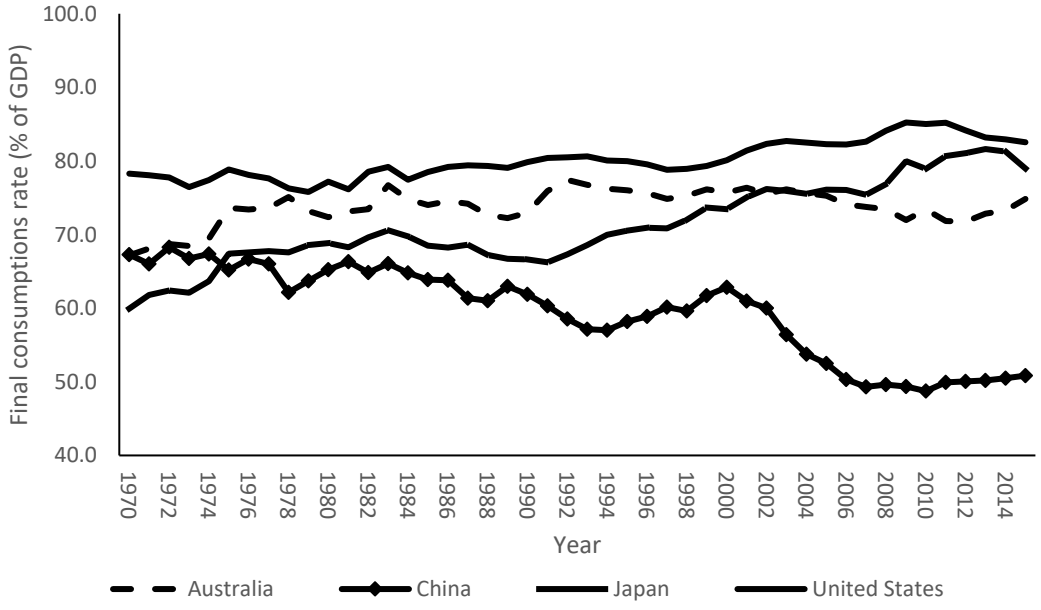

Figure 5. 1 Final consumption rates in China, Australia, Japan and US, 1970-2015

Sources: World Bank. 2016. World Bank Indicators.

The final consumption expenditure in China includes both the household and the government final consumption expenditure, the latter of which has remained at the same level (about 13%) in the past forty years (NBS, 2015). Therefore, the decline in the household consumption rates is the key factor affecting China's decreasing domestic consumption rates (Chen and Chen, 2009). In 1978, the household consumption rate was 48.4%, decreasing to 37.4% in 2014, thus contributing to the decline in the domestic consumption rates in China (NBS, 2015). The worldwide average household consumption rate was 58.3% in 2014, which is about 21% higher than that in China (World Bank, 2016). At the same time, the share of household consumption expenditure in the final consumption expenditure of the country exhibited an apparent downward trend during the same period, from about 80% in 1980 to 73% in 2015 (NBS, 2016). The declining household consumption rates mainly stem from the uncertainty regarding income in the future, inequality in primary distribution of national income account, high household savings, and decreasing average propensity to consume in the country (Xu, 2005; Xu and Li, 2005; Li and Yin, 2007; Li et al., 2008; Chen, 2012).

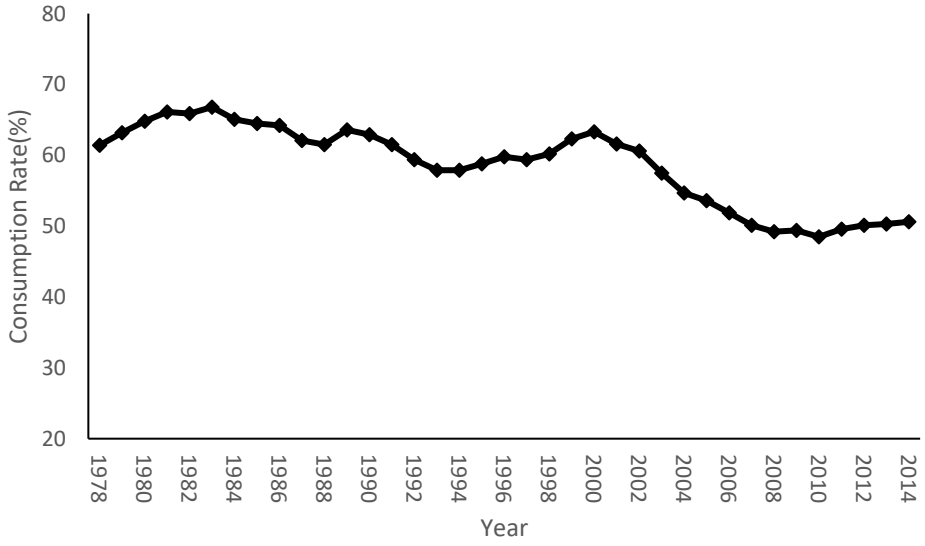

Figure 5. 2 Domestic consumption rates in China, 1978-2015

Sources: National Bureau of Statistics, 2015 Statistic Yearbook, China Statistics Press, 2016

In addition to the significant downward trend, China's household consumption rates show large regional differences, which are attributed to the dual structure in society and economy, and thus further widen the disparity between rural and urban areas (Smyth, Nielsen and Zhai, 2010; Chen, 2012). The household consumption expenditure in urban areas was historically at a much higher level and experienced a more rapid growth than that in rural areas of the country (NBS, 2016). Before 1990, the household consumption expenditure in rural and urban areas was almost at the same level, which was less than 1,500 *yuan* (Figure 5.3). Since the 1990s, the household consumption expenditure in both rural and urban areas started to increase rapidly, due to the rapid economic and income growth. However, the gap in household consumption expenditure between rural and urban households in the country is rapidly widening. Based on the most recent statistical report published by NBS in 2016, the consumption per capita was 21,392 *yuan* and 9,223 *yuan* in urban and rural areas, respectively, at the end of 2015.

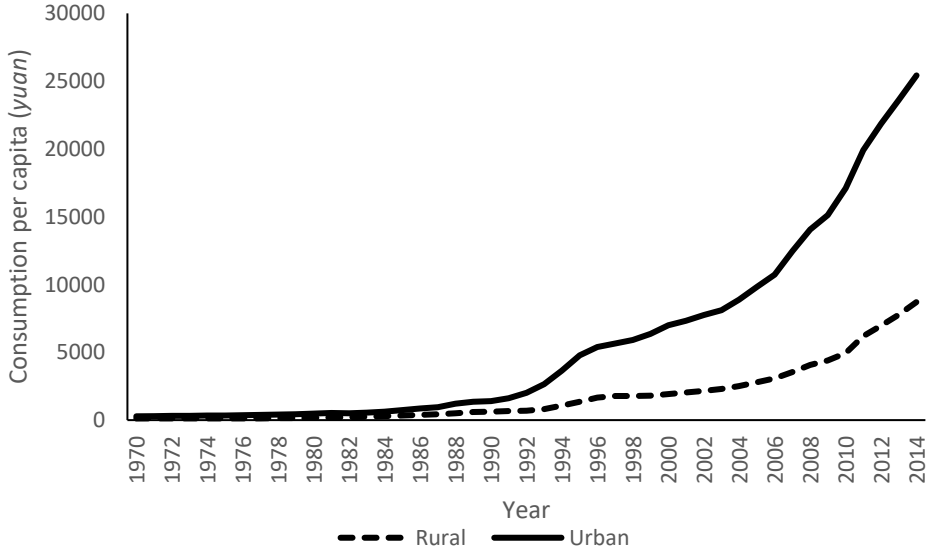

Figure 5. 3 Rural and urban household consumptions in China, 1970-2015

Sources: National Bureau of Statistics. 2016. China Statistical Yearbook 2015. Beijing: China Statistics Press

Along with the declining household consumption rates in China, the household savings rates correspondingly fluctuated at a high level, which benefited the social capital accumulation and provided abundant investments for China's economic growth. Over the past several decades after the Reforms and Opening Up in China, the economy has been greatly dependent on the large amounts of government-led investments. However, the sustainability of this economic growth pattern, which was evident in East Asia decades ago and has resulted in high investment and high growth, is presently being questioned (Krugman, 1994; Chang, 2006). Considering that the investment demand is directly determined by the consumption demand, the declining consumption rates indicate that the economic growth based on long-term dependence on large amounts of investments is unsustainable. At present, the Chinese economy is confronted with insufficient domestic demands, declining household consumption rates and high savings rates, which would challenge the economic growth in the future. The government has recently been investing considerable resources into boosting its domestic demand and increasing the domestic consumption through economic reforms and economic restructuring, which has resulted in a slight increase in the domestic consumption rate after 2010. However, China is still facing many challenges and problems regarding its domestic consumption rate and economic development strategy of maintaining its economy's sustainability in the next future.

5.3 Ageing and household consumptions: Evidence from macro data

5.3.1 Data and method

The macro-level data used in this study was sourced from China Statistical Yearbooks that have been published by the National Bureau of Statistics during 1997−2010, China Compendium of Statistic 1949−2014 and the statistical yearbooks of each province published during the period, as those adopted in the macro-level analysis in Chapter 4.

Based on the provincial panel data, the system GMM model was employed in the present study, aiming to overcome the shortages of providing unbiased and efficient estimations in OLS model, FE / RE models and differenced GMM model (Blundell and Bond, 1998; Blundell et al., 2000). To examine the impacts of ageing on household consumptions, the study defines the dependent variable as the ratio of household consumptions to income, which is referred to as average propensity to consume (APC). Definitions of explanatory variables included in the analysis are presented in Table 5.2, as reviewed in Chapter 4.

Table 5. 2 Variables definitions and descriptions

Variable	Definition	Mean	Std. Deviation
APC	ratio of household consumption to income	0.47	0.11
ODR	the old-age dependency ratio	11.45	2.53
OGR	the old people growth rate	2.96	9.02
GUI	the growth rate of urban disposable income	9.93	4.10
GRI	the growth rate of rural net income	9.26	12.57
URP	ratio of urban income to rural income	3.03	0.72
PGDP	the growth rate of per capita GDP	13.45	6.11
UR	unemployment rate	3.62	0.76
CPI	consumption price index	1.02	0.24
IR	interest rate	3.00	1.42
FEP	proportion of fiscal expenditure to GDP	17.79	13.06
GTP	proportion of government tax to GDP	6.04	2.42
RS	social endowment pension coverage rate	26.32	18.74
OPEN	net exports to GDP	3.91	5.19

Sources: Natioanl Bureau of Statistics, China Statistical Yearbooks 1997−2010, Beijing: China Statistics Press.

The model adopted in analysis is depicted by the following expression:

$$APC_{i,t} = \alpha_0 \cdot APC_{i,t-1} + \alpha_1 \cdot ODR_{i,t} + \alpha_2 \cdot OGR_{i,t} + \beta \cdot X_{i,t} + \lambda_t + \mu_i + \varepsilon_{i,t}$$

Where $APC_{i,t}$ denotes the average propensity to consume of province i at time t; $ODR_{i,t}$ denotes the old-age dependent ratio of province i at time t; $OGR_{i,t}$ denotes the old population

growth rate of province i at time t; $X_{i,t}$ denotes other controlling variables. λ_t denotes the unobserved time-varying fixed effect, which has no association with provinces. μ_i denotes the unobserved regional fixed effect, which has no association with time. $\varepsilon_{i,t}$ denotes the random error term. t demotes time. i denotes different provinces.

5.3.2 Multivariate analysis

The analysis commences by examining the gross effect of old-age dependency ratio and elderly population growth rate on China's household consumption without controlling for other socio-economic variables, as shown in Table 5.3. The coefficient estimation of APC_{t-1} using system GMM model is between those using pooled OLS model and FE model, indicating an efficient estimator of system GMM model in this analysis (Nickell, 1981; Hsiao, 1986). The system GMM estimation results indicate that the old-age dependency ratio indeed exerts a significant and negative effect on the household average propensity to consume. Further, the growth rate of the old population exhibits a significantly negative and smaller effect on household average propensity to consume, indicating that China's households would consume less due to population ageing.

Table 5. 3 Model results of ageing and consumptions

	Pooled OLS	FE model	system GMM
Lag_APC	0.91(0.024)***	0.80(0.034)***	0.90(0.032)***
ODR	-0.0009(0.0005)**	-0.0032(0.0011)***	-0.0013(0.0006)**
OGR	-0.0002(0.00014)	-0.00003(0.00015)	-0.0004(0.00018)**
Constant	0.077(0.077)***	0.182(0.033)***	0.0808(0.027)***

Notes: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

To further investigate the association of population ageing with the household average propensity to consume, the system GMM model was conducted after controlling for other socio-economic variables in the model. The last column of Table 5.4 shows the final regression model results of the system GMM estimation. It is evident that population ageing exerts significant and negative effects on household average propensity to consume, both in old-age dependency ratio and old population growth rate. The old-age dependency ratio has a positive and statistically significant effect on household average propensity to consume. More specifically, an increase of 1% in the old-age dependency ratio results in a decline in household average propensity to consume by 0.34%. On the other hand, elderly population growth rate exerts a significant negative effect on household consumption rate as well, albeit smaller than the effect of the old-age dependency ratio. In sum, population aging affects China's household average propensity to consume negatively, which provides no evidence in support the application of life cycle hypothesis in China’s case. The possible explanation for this finding would be closely linked with the precautionary savings and bequest motives, resulting from a rapidly ageing population (Yuan and Song, 2000; Xu, 2012), which requires further analysis. The negative effects of ageing on household average propensity to consume could be substituted by adequately developed social security system to some extent, which is suggested by the model results. In addition, public expenditure also exhibits a significant effect on household average propensity to consume, which reveals the crowding-out effect of public expenditure on household consumption.

Table 5. 4 GMM model results of ageing and household consumption rates

APC	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)
Lag_APC	0.96***	0.96***	0.92***	0.96***	0.95***	0.93***	0.95***	0.96***	0.94***	0.95***	0.96***	0.95***
ODR	-0.0008**	-0.0012***	-0.001***	-0.0008***	-0.001***	-0.0012***	-0.0012***	-0.0012***	-0.0013***	-0.0012***	-0.001***	-0.0034***
OGR	-0.00037***	-0.0003***	-0.0003***	-0.0005***	-0.0003***	-0.00038***	-0.0003***	-0.0004***	-0.00036***	-0.00035***	-0.00032***	-0.0007***
GUI	-0.001***											0.001
GRI		-0.0004***										-0.0004
URP			0.0028**									0.002
PGDP				-0.0008***								-0.0003
UR					0.004***							0.01***
CPI						-0.2***						-0.081
IR							-0.003***					0.007**
FEP								-0.00004				-0.00018**
GTP									0.0004**			0.00082
RS										0.00006**		0.00009
OPEN											0.000057	0.001**
Constant	0.043*	0.04*	0.056***	0.044*	0.03**	0.26***	0.055***	0.04	0.05**	0.0435**	0.034	0.092*
Obs.	403	403	403	403	403	403	403	403	403	403	403	403
Hansen	0.879	0.859	0.989	0.897	0.881	0.962	0.715	0.984	0.811	0.752	0.761	0.997
AB Test for AR2	0.09	0.1	0.19	0.19	0.17	0.39	0.22	0.18	0.19	0.18	0.19	0,31

Notes: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

5.4 Ageing and household consumptions: Evidence from micro data

5.4.1 Data and method

The macro-level data analysis suggests that population ageing, as measured by the old-age dependency ratio and the growth rate of the elderly population, exerts a significant negative effect on the household average propensity to consume. For further analysis of the rationale of ageing and household consumption, the present study examines the association of ageing with household consumption at household-level using micro-level data.

The micro-level data used in this chapter was from the China Family Panel Studies (CFPS) survey conducted in 2010 by the Institute of Social Science Survey at Peking University in China. As introduced previously in Chapter 4, this survey is nationally representative of the Chinese society, focusing on the economic as well as noneconomic well-being of the population, gathering a wealth of information covering topics such as economic activities, educational outcomes, family dynamics and relationships, migration, and health (Xie and Hu, 2014). In addition, the survey collects information of variables at multilevel, which is suitable for the employment of Hierarchical Linear Model. In the present study, the HLM method was adopted to examine the effect of ageing on household consumption, which is defined as the logarithm of household consumption per capita, whereby the model incudes variables at household-, community-, and provincial level.

5.4.2 Descriptive analysis

The Chinese households have been experiencing profound changes in the past decade. In 2000, the average household size in China was 3.44 persons per household; however, it declined to 3.10 in 2010 (NBS, 2002, 2012). The proportions of households in which several generations live together also changed during this period, whereby the percentage of one-generation

households increased by 12.5%, while the proportion of households with two generations declined (Table 5.5). In addition, the share of households including elderly persons aged 65 and above increased from 20% in 2000 to 22% in 2010. Within these households, the proportion of households with one elderly person declined from 72.6% in 2000 to 67.6% in 2010, while the share of households with two elderly persons increased from 27.1% to 32.1% (Table 5.6). These results show that Chinese households have recently experienced great changes, one of which is ageing, whereby the share of households including elderly persons (aged 65 and above) has increased.

Table 5. 5 Household structures in China, 2000 and 2010 (%)

	Households with one generation	Households with two generations	Households with three generations	Households with four generations	Households with five and above generations
2000	21.702	59.316	18.245	0.737	0.001
2010	34.176	47.828	17.307	0.689	0.001

Sources: Population Census Office under the State Council, Department of Social Science and Technique Statistics at National Bureau of Statistics. 2002. Tabulation on the 2000 Population Census of the People's Republic of China. Beijing: China Statistics Press; Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

Table 5. 6 Households with elderly persons aged 65+ in China, 2000 and 2010(%)

	Households with one 65+ person	Households with two 65+ persons	Households with 3 and more 65+ persons	Households with 65+ persons
2000	72.56	27.10	0.34	20.09
2010	67.55	32.07	0.38	21.90

Sources: Population Census Office under the State Council, Department of Social Science and Technique Statistics at National Bureau of Statistics. 2002. Tabulation on the 2000 Population Census of the People's Republic of China. Beijing: China Statistics Press; Population Census Office under the State Council, and Department of Population and Employment Statistics at National Bureau of Statistics. 2012. Tabulation on the 2010 Population Census of the People's Republic of China. Beijing: China Statistics Press.

The distribution of household consumption (logarithm values) in China is presented in Figure 5.4, with an approximate normal distribution based on the micro-level survey data. In 2010, the mean consumption of Chinese households was about 35,000 *yuan*, while the median value of household consumption was only about 20,000 *yuan*, suggesting significant skew in the distribution. Further analysis revealed that, in 2000, 75% of Chinese households consumed goods and services valued at about 36,000 *yuan*. The household consumption variance in China is significant, with a standard deviation exceeding 50,000 *yuan*. Thus, in the next stage of analysis, the aim is to identify variables contributing to this large variance in Chinese household consumption, with a particular focus on ageing within households.

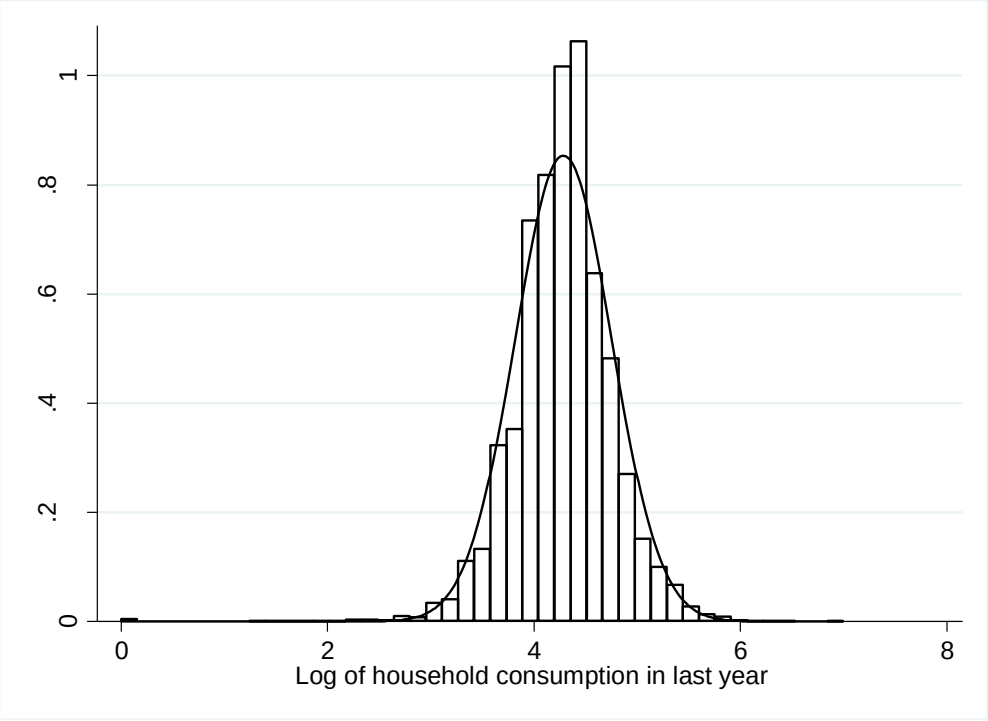

Figure 5. 4 Distribution of household consumptions in China, 2010

5.4.3 Bivariate analysis

To examine the correlation between household consumption and observed variables, bivariate

analyses are conducted. Without controlling for other variables, the average consumption per capita of households with different age groups is examined, along with the correlation between these two variables (Table 5.7). The results show that the household consumption per capita declined significantly as the average household age increased. For example, when the average age within households was below 40, the household consumption per capita was about 16,085 *yuan.* On the other hand, in households with the average age above 65, the household consumption per capita was only 12,621 *yuan*. The correlation coefficient between average age and household consumption per capita is -0.13, and is statistically significant at 0.001 level. This finding suggests that the household consumption per capita is negatively associated with the average household age, and would therefore decline as the population starts to age.

Table 5. 7 Household consumptions per capita and age of householders (*yuan*)

Average age within households	Household consumption per capita
<40	16,085.15
40-65	14,258.25
65+	12,620.86
Correlation coef.	-0.13***

*Notes: *** denotes significant at 1‰ level.*

A significant variance also exists in the distribution of the household consumption per capita among households of different average ages. For example, more than 50% of the young households with the average age below 40 consume more than the median value. On the other hand, the consumption among the older households is skewed to the left, as more than 50% of these household consume less than the median value (Table 5.8). These findings further suggest that the consumption distribution depends on the household age structure.

Table 5. 8 Median test of consumptions and average age within households

Household consumptions		<40	40-65	65+
Greater than the median	no	0.48	0.53	0.55
	yes	0.52	0.47	0.45
Pearson Chi2			89.60***	

*Notes: *** denotes significant at 1‰ level.*

As supporting old parents is one of the most important functions in Chinese families, having an elderly parent would directly affect the economic behaviours within households in China. To investigate the impact of having or not having elderly parents on the household consumption, bivariate analysis was conducted with having/not having elderly parents and household consumption per capita as variables. Based on the analysis results, having elderly parent could significantly increase the household consumptions, which counters the conclusion drawn from macro-level results. Therefore, multivariate analysis is conducted next.

Table 5. 9 Household consumptions per capita and supporting the elderly (*yuan*)

	Obs.	Mean	Std. Err	Std. Dev.
Having no old parent	9,551	28,450.1	447.9	43,775.5
Having old parents	9,156	35,308.5	665.6	63,686.4
Diff.		-6858.4	796.2	-8419.1
t value			-8.6***	

*Notes: *** denotes significant at 1‰ level.*

5.4.4 Multivariate analysis

The bivariate analysis above suggests that household consumption is closely associated with the age structure and having/not having old parents or not. To further examine the effects of

ageing within households on their consumption behaviours, the Hierarchical Linear Model (HLM) was employed, which incorporates variables at the household-, community-, and provincial level. Two variables at the community level are included, an ordinary variable measuring economic conditions and a dichotomous variable with 1 denoting urban and 2 referring to rural households. At the provincial level, GDP growth rate is adopted to reflect the social and economic development.

To examine the contribution of variables at each level to the variance in household consumption, a null model was first developed, without controlling for any explanatory variables:

$$y_{ij} = \gamma_{00} + \delta_{0j} + \varepsilon_{ij}$$

where y_{ij} denotes the household consumption per capita (logarithm values) in community i of province j; γ_{00} denotes the mean value of dependent variable; δ_{0j} denotes the random effect within provinces, describing the variance between province j and the mean of dependent variable; and ε_{ij} denotes the random effect within households, measuring the variance within households in community j.

The null model results are presented in Table 5.10, which provides the estimation of the variance variables at different levels. Based on the model results, the contributions of variables at different levels to the total variance in the dependent variable were calculated. The results suggest that the variable at the provincial level could explain about 17% of the total variance in the household consumption per capita, while the community-level variables could explain about 24%, and the variables at the household level contribute about 59% of the total variance in household consumption.

Table 5. 10 HLM Null model results of household consumptions

	Coefficient	Std. Err	Z	P
Constant	3.943	0.028	138.4	0.000
Random-effects	Estimate	Std. Err	95% CI	
Province:				
Var(_cons)	0.1319	0.0225	0.0944	0.1842
Community:				
Var(_cons)	0.1848	0.0069	0.1718	0.1987
Var(Residual)	0.4450	0.0027	0.4397	0.4504

Controlling for other explanatory variables, a random effect model was developed to explore the relationship between household consumption per capita and the key explanatory variables. In the model, the logarithm value of household consumption per capita is the dependent variable, and the explanatory variables include the average age within households, having/not having children aged 0−14 within households, household size, the logarithm value of household yearly income; marital status and educational attainment of householders.

The main results of the random effect model are presented in Table 5.11. Controlling for the other variables, the age of householder exerts a significant negative effect on consumption per capita. For households that do not have elderly parents aged 65 and above, the household consumption per capita would decrease by 1.1% if the age of householder increased by one year. This relationship is also supported in the households having elderly parents, albeit with a smaller correlation coefficient. In these households, if the average age within households increased by one year, the household consumption per capita would decline by 0.8% (Table 5.11). These results provide evidence supporting the assertion that ageing within households would decrease their consumption per capita, which is in agreements with the macro-level data analysis findings. In addition to the age of householder, having/not having children aged 0−14 significantly affects the household consumption per capita as well. In households without

elderly parents, having children aged 0−14 would decrease the household consumption per capita by 16.1%, which is statistically significant. On the other hand, in the households having elderly parents, having children aged 0−14 would reduce the household consumption per capita by 15.8%, which is also statistically significant. However, supporting old parents would increase the household consumption per capita, while which is statistically insignificant.

Table 5. 11 HLM results of ageing and household consumptions

Log (consumption per capita)	All households		Having no old parents		Having old parents	
age of householder	-0.010	0.001***	-0.011	0.002***	-0.008	0.002***
Having old parents (Ref. No)						
Yes	0.016	0.021				
Having young children (Ref. no)						
Yes	-0.163	0.027***	-0.161	0.051***	-0.158	0.034***
household size	-0.170	0.006***	-0.167	0.008***	-0.179	0.009***
Log (income)	0.358	0.010***	0.333	0.013***	0.403	0.015***
Housing (Ref. Self-owned)						
Rent	0.017	0.045	0.010	0.070	0.031	0.057
Living in others' house	-0.088	0.038**	-0.048	0.055	-0.108	0.052**
Hukou (Ref. Non-agriculture)						
Agriculture	-0.188	0.027***	-0.286	0.038***	-0.120	0.036***
Gender (Ref. Female)						
Male	-0.006	0.022	0.032	0.033	-0.039	0.031
Marriage (Ref. Unmarried)						
Married	0.197	0.069***	0.242	0.098**	0.189	0.099*
Divorced/widowed	0.276	0.074***	0.305	0.103***	0.287	0.109***
Education (Ref. Primary sch.)						
Middle sch.	0.095	0.022***	0.082	0.032**	0.111	0.030***
High sch.	0.196	0.030***	0.168	0.045***	0.228	0.040***
College and above	0.378	0.044***	0.339	0.071***	0.423	0.057***
Employment (Ref. unemployed)						
Employed	-0.075	0.025***	-0.086	0.033***	-0.068	0.037*
Constant	6.070	0.140***	6.363	0.188***	5.570	0.200***

Note: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

When data pertaining to all households are included in one model, the results yielded support a significant and negative relationship between the age of householder and consumption per capita as well. Thus, it can be asserted that, in China, ageing in householders would significantly affect the household consumption per capita. Based on the model results obtained when all samples are analysed jointly, having elderly parents might increase the household consumption per capita. If the family had elderly parents, the household consumption per capita would decrease by 1.6%, however, it is statistically insignificant. In addition, having children aged 0−14 exhibits a significant negative association with household consumption per capita, probably resulting from the increasing precautionary savings in response to the growing investments in children's education in the future (Xu, 2012).

The results reported above reveal a significant and negative relationship between household consumption per capita and ageing within householders, providing with the insight of the rationale of ageing and household consumption. To further explore the influence of supporting elderly parents on household consumption per capita, an HLM model was developed using only data pertaining to households having old parents.

The HLM results pertaining to the effects of supporting elderly parents on household consumption per capita are presented in Table 5.12. Based on the model results, the effects of supporting elderly parents are complex, and are associated with mothers' age and education attainments. The results show that, if the elderly mother is older than 65, supporting elderly parents would decrease the household consumption per capita, which is statistically insignificant, with a growing effect along with increases in elderly mother's age. Supporting elderly parent would negatively affect household consumption per capita, which is in consistence with the macro-level analysis. In addition, elderly mothers' education is positively

associated with the household consumption per capita. Due to their higher economic and social status, elderly mothers who have high educational attainment could positively affect the household consumption per capita through intergenerational wealth transfer.

Table 5. 12 HLM results of supporting the elderly and household consumptions

	Coef.	Std. Err.
age of householder	-0.005	0.002*
Age of mother (Ref. <64)		
65-85	-0.003	0.034
85+	-0.061	0.051
Education of mother (Ref. Primary sch.)		
Middle sch.	0.043	0.055
High sch.	0.186	0.058***
College and above	0.159	0.059***
Having young children (Ref. no)		
Yes	-0.176	0.036***
household size	-0.169	0.013***
Log (income)	0.408	0.020***
Housing (Ref. Self-owned)		
Rent	0.037	0.046
Living in others' house	-0.075	0.048
Hukou (Ref. Non-agriculture)		
Agriculture	-0.073	0.041*
Gender (Ref. Female)		
Male	-0.002	0.031
Marriage (Ref. Unmarried)		
Married	0.161	0.087*
Divorced/widowed	0.299	0.119**
Education (Ref. Primary sch.)		
Middle sch.	0.109	0.035***
High sch.	0.246	0.027***
College and above	0.420	0.047***
Employment (Ref. unemployed)		
Employed	-0.029	0.041
Constant	5.248	0.226***

Note: * denotes significant at 10% level; ** denotes significant at 5% level; *** denotes significant at 1% level.

5.5 Population ageing and household consumption structure in China

China is undergoing a rapid population ageing process, which affects its household consumption rate. Due to various consumption demands among age groups, population ageing would affect household consumption structure as well. Thus, the present study explores the association of ageing with household consumption structure.

5.5.1 Data and method

The data used in this section was sourced from China Statistical Yearbooks published by the National Bureau of Statistics in China during 2001−2011. These data provide information of household consumption and population age structure, allowing the relationship between population age structure and household consumption structure to be examined. Based on the definition of NBS, household consumption was divided into eight categories: food, clothes, housing, household equipment & services, medical care, transportation & communication, education & entertainment, and other goods & services. The changes in population age structure were captured by proportions of three age groups in total population: children aged 0−14, working-age population aged 15−64, and the elderly aged 65 and above. Obviously, the two sets of data vary along with time. Thus, the Grey Relational Analysis method was adopted to investigate the correlation of population ageing and household consumption structure during the period, which provides the approach of analysing two sets of time-varying variables.

5.5.2 Grey Relational Analysis results

The household consumption structure in China changed considerably during 2000−2010. Household consumption on transportation & communication increased by 6.19%, while household food consumption declined by about 3.77%. These changes in household consumption structure suggest that the Chinese have started to change their consumption

preferences and demands. The downward trend in the food consumption as a proportion of household expenditure in 2000−2010 indicates a declining Engel's coefficient. This shift is mainly caused by rapid growth in household income in China during the recent decades, benefitting from high economic growth. In addition, the increase in household transportation & communication cost suggests that the Chinese household consumption demands for transportation and communication was growing during 2000−2010, as a result of China's rapid development and significant investment into public transport and communication technologies.

Table 5. 13 Household consumption structure in China, 2000-2010 (%)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
food（X1）	39.44	38.20	37.68	37.12	37.73	36.69	35.78	36.29	37.89	36.52	35.67
clothes（X2）	10.01	10.05	9.80	9.79	9.56	10.08	10.37	10.42	10.37	10.47	10.72
housing（X3）	11.31	11.50	10.35	10.74	10.21	10.18	10.4	9.83	10.19	10.02	9.89
household equipment & service（X4）	7.49	7.09	6.45	6.30	5.67	5.62	5.73	6.02	6.15	6.42	6.74
medical care（X5）	6.36	6.47	7.13	7.31	7.35	7.56	7.14	6.99	6.99	6.98	6.47
Transportation & communication（X6）	8.54	9.30	10.38	11.08	11.75	12.55	13.19	13.58	12.6	13.72	14.73
education entertainment service（X7）	13.40	13.88	14.96	14.35	14.38	13.82	13.83	13.29	12.08	12.01	12.08
Other goods & service (X8）	3.44	3.51	3.25	3.30	3.34	3.5	3.56	3.58	3.72	3.87	3.71

Sources: National Bureau of Statistics, China Statistics Yearbooks 2001-2011, China Statistics Press

As previously noted, China's demographic environment also changed in this period. More specifically, proportion of children aged 0−14 in total population decreased from 22.89% in 2000 to 16.60% in 2010. On the other hand, the share of working-age population (those aged 15−64) in total population increased from 70.15% to 74.53% in the same period, while the proportion of the elderly (aged 65 and above) increased as well, from 6.96% in 2000 to 8.87%

in 2010. The changes in proportion of these three age groups suggest that China recently experienced significant population ageing.

Table 5. 14 Population age structure in China, 2000-2010 (%)

Year	0-14 (Y1)	15-64 (Y2)	65 above (Y3)
2000	22.89	70.15	6.96
2001	22.50	70.40	7.10
2002	22.40	70.30	7.30
2003	22.10	70.40	7.50
2004	21.50	70.92	7.58
2005	20.27	72.04	7.69
2006	19.75	72.32	7.93
2007	19.42	72.53	8.05
2008	18.95	72.80	8.25
2009	18.48	73.05	8.47
2010	16.60	74.53	8.87

Sources: National Bureau of Statistics, China Statistics Yearbooks 2001-2011, China Statistics Press

This data was subjected to the Grey Relational Analysis method to investigate the correlation between population age structure and household consumption structure. For the analysis, household consumption structure data serve as key performance measures, while the data pertaining to population age groups are treated as influential factors.

First, the data transformation was standardised to exclude the measurement unit effects, whereby all values in the dataset are divided by the first value, yielding standardised data set.

Secondly, the absolute difference of the compared series and the referential series was obtained by applying the expression: $\Delta Y_j X_k = \left|Y_j - X_k\right| \ (j = 1, 2, 3; k = 1, 2, 3 \ldots 8)$, which allows identifying the maximum and the minimum differences.

Third, the relational coefficient $\mathrm{e}(\Delta Y_j X_k)$ was calculated using the following formula: $\mathrm{e}(\Delta Y_j X_k) = \left[min(\Delta Y_j X_k) + \xi \cdot max(\Delta Y_j X_k)\right] / \left[\Delta\, Y_j X_k + \xi \cdot max(\Delta Y_j X_k)\right]$, where ξ is

usually set as 0.5.

Finally, the relational degree matrix was calculated using the expression: $\mathrm{r} = \frac{1}{n} \cdot e(\Delta Y_j X_k)$

The Grey Relational Analysis results suggest that different age groups have different consumption demands (The detailed calculation steps and results are referred to as Appendix D). In particular, when compared with young children and working-age population, the elderly had the lowest consumption demands in China during 2000−2010. This discrepancy indicates that the country's household consumption would further decrease as the population is ageing rapidly and this trend is expected to continue in the future. Specifically, elderly Chinese have lower demand for food, clothes, housing, transportation and communication than the youth and working-age population. However, the elderly requires much greater medical care than the remaining two groups.

5.6 Conclusion and discussion

Population ageing is gradually becoming the greatest demographic issue in China, as the proportion of elderly will experience rapid growth due to large cohorts entering old ages in the near future. The rapidly growing elderly population would have unprecedented and profound implications for the society and the economy in the county. At the same time, the Chinese economy is experiencing insufficient domestic consumption. When considered jointly, these two issues would exert enduring and complex influences to the country's economy. Against this background, the relationship between ageing and household consumption was examined in the present study from both macro and micro perspective.

In the past two decades, evidence of China's population ageing could be found throughout the country, as indicated by increasing old-age dependency ratios in each province. Using the provincial panel data for the 1997−2010 period, the relationship between population ageing and

household consumption rates was investigated from the macro perspective. The macro-level analysis results show that the increasing old-age dependency ratio exerts a significant negative effect on household consumption rates. Comparatively, the elderly population growth rate exhibited a much stronger relationship with household consumption rates during the same period. These findings suggest that population ageing would be negatively associated with domestic consumption rates in China in the future, and challenged the application of life cycle theory in China's case.

To further elucidate the effects of population ageing on household consumption, and discern the mechanism through which ageing affects household consumption, HLM models were developed using micro-level data sourced from the China Family Panel Studies survey. The Chinese households are experiencing drastic changes in both size and structure. During the period from 2000 to 2010, the Chinese households reduced in size, while the proportion of households with old persons (aged 65 and above) increased, confirming that Chinese society is ageing. The HLM models based on the micro-level survey data provide insight into the relationship between ageing and consumption within households. Their results show that household consumption is directly affected by multilevel variables, including those at the household-, community-, and provincial level. The province-level variables contribute about 17% of the total variance in household consumption, while the community-level and household-level variables explain about 24% and 59% of the variance in household consumption, respectively. The model results further show that ageing within households, measured by age of householders, exerts a significant negative effect on household consumption per capita. More specifically, if the age of householder increased by one year, the household consumption per capita would decrease by 1.0%. These findings support the conclusion drawn from the macro-

level data analysis, which indicated that population ageing would reduce household consumption. In addition, having children aged 0−14 would also negatively affect the household consumption per capita, due to the need to secure funding for children's education in the future.

Using micro-level data, the influence of supporting old parents on household consumption was also investigated. The model results show that having old parents would increase the household consumption per capita in China, which is statistically insignificant, and this relationship is affected by old mothers' age and education. If the old mother is older than 65, supporting old parents would decrease the household consumption per capita. These findings suggest that supporting elderly parents jeopardises the welfare of households, which is also supported by the macro-level analysis. Ageing could affect household consumption through three mechanisms: consumption effect, precautionary savings effect and bequest motives effect. As consumers, the increases in old population would increase the household consumption, which is referred to as consumption effect. However, the ageing would also bring increases in precautionary savings and wealth accumulation out of bequest motives, which in turn reduce the consumption. Thus, the influence of ageing on consumption is the complicated product of these three effects. In China's case for the period of 1997 to 2010, the latter two effects of ageing on household consumptions were obviously much stronger, which resulted in a negative association with household consumption in analysed period. The characteristics of close intergenerational association and intensive saving motives in China challenge the application of life cycle theory in the country, which is lack of significance of bequest motives and precautionary savings.

In addition to household average propensity to consume and household consumption per

capita, the impact of ageing on household consumption structure was also examined using macro-level data. The findings support the previous assertion that population ageing would significantly affect the structure of goods and services Chinese households consume. The consumption of and the demand for medical care and household services would increase, while household expenditure on food and clothing would decrease. Nonetheless, it should be recognised that intergenerational differences in consumption structure would largely affect the household consumption structure in the future.

The negative effects of ageing on household consumption are supported by evidence generated by both macro- and micro-level data. These findings reported in this chapter could inform the formulation of related policy on boosting household consumptions and dealing with ageing issues in the country. As discussed, China is facing with a rapid population ageing process and the transition stage in economy from investment-driven to consumption-lead. In this context, the effort needs to be devoted to balance the demographic changes and economic sustainable growth in the future. Given the inevitable influence of ageing on the economy and society in the country, the governments are suggested to introduce measures that can address these unprecedented challenges to domestic consumption, including developing the social endowment system to ease the burden of supporting the elderly, and seeking more practical solutions, not only pertaining to domestic consumption, to boost its economy. In addition, due to data availability, analysis on differences in consumption behaviours among different cohorts could not be taken into consideration in this study even though it also plays an important role in contributing to household consumptions in the future. Comparing to older cohorts, younger cohorts present much higher consumption level and different consumption structure in goods and services. If data are available, further study is needed to take cohorts into consideration.

Chapter 6 Conclusions and discussion

The aim of the present study is to examine China's demographic future under the two-child policy, as well as to discern the effects of the population ageing in the country on labour force supply, and household savings and consumption patterns. By developing the fertility rate simulation model, the changes in women's fertility rates under sudden policy adjustments were explored, which have not been adequately understood. Using the estimation results of the total fertility rates, the demographic consequences of the two-child policy in China were projected, indicating that the ageing process in the country will accelerate during the next four decades. The investigation proceeded with the review of the changes and challenges in labour force structure in China, which allowed the impact of population ageing on labour force supply to be investigated, with particularly focusing on the influences on labour force participation rates and productivity. Moreover, as a part of the present study, the impact of population ageing on household savings was examined from both macro and micro perspective, using system GMM model, Binary Logistic regression and HLM model, whereby the aim was to identify the mechanisms through which ageing affects household savings. Finally, analyses were conducted to ascertain the relationship between population ageing and household consumption, using evidence yielded by macro- and micro-level data. The findings of these investigations are discussed in the following sections.

6.1 Main conclusions

6.1.1 Demographic future in China under the two-child policy

The Chinese government implemented the two-child policy in 2016, aiming to address the ensuing demographic issues caused by the long-term one-child policy. In Chapter 2, the demographic future in China under the two-child policy was examined.

The investigation reported in this chapter commenced by building a simulation model to estimate women's fertility rates under the two-child policy in China, which enhances the understanding of the effect of sudden policy adjustments on fertility rates. The simulation results suggest a temporary but significant increase in total fertility rates in China due to the implementation of the two-child policy. The fertility rate is projected to peak at 1.97 around 2020, resulting in a greater number of births due to the cumulative effect on second births and enlarged female population meeting the requirements of regulations. The increase in fertility rates would directly lead to a greater number of births per annum, due to the implementation of the two-child policy in China. A peak value of 18.8 million is projected for 2019, which would result in a much greater demand for childcare and kindergarten placements. During this period, the Chinese population will keep increasing, and will peak in 2026 at 1,425 million, which is 28 million more than the number recorded under the one-child policy. The increase in total population caused by the new policy will become more rapid in the future, whereby in 2050, there would be 77 million more Chinese citizens compared to the period under the one-child policy. In addition, the two-child policy could exert significant but limited effects on labour force supply and the population ageing in the next four decades. China will undoubtedly face inevitable population ageing, resulting from its long-term one-child policy and rapid demographic transition process.

6.1.2 Changes and challenges in labour force supply in China

In Chapter 3, the changes and challenges associated with the labour force composition and supply in China were investigated before examining the effect of population ageing on labour force supply, focusing on labour force participation rates and productivity, and analysis of the labour force supply in the future.

After experiencing the benefits of the abundance of cheap labour force for three decades, the Chinese economy recently witnessed some profound and enduring changes in the labour force supply. Firstly, the size of working-age population peaked in 2013, at 1,006 million, implying the diminishing of the first demographic dividend and the arrival of the Lewis turning point in China. As a result, it can be expected that the country will have a decreasing labour force in the near future. Secondly, the Chinese economy is experiencing increasing labour costs, as the wages of employed population have increased by seven-fold since the 1990s. Thirdly, the productivity in China is much lower than that reported in developed countries, which further weakens the competitiveness of the economy in international trade.

Population aging exerts significant negative effects on labour force supply. Firstly, the accelerating population ageing results in an increasing dependency ratio in the country, which indicates a growing dependency burden for the labour force. Moreover, due to the ageing in labour force, the proportion of older workers would increase, while the share of younger workers would decrease, negatively affecting the labour force participation rates and productivity. In order to examine this phenomenon, in Chapter 3, the standardisation method was adopted to examine the influence of labour force ageing on the labour force participation rates during the 2000−2010 period. The results revealed that the labour force ageing led to a 1.7% decline in overall participation rate during this period, and thus contributed about 24% to the decrease in labour force participation rates in 2000−2010. In addition, the ageing in labour force would negatively affect productivity in China. However, in the long term, labour force ageing would increase investments in education and human capital accumulation, which is likely to increase productivity and boost the sustainability of economic growth in China. The influence of labour force ageing on economic growth was also investigated by applying the

production function. The findings suggest that labour force ageing slightly hindered the economic growth in the examined period, which was offset by the rapid economic growth in the country.

Using the population projection results, the labour force supply in China in the next four decades was also investigated. The findings revealed that the dependency ratio would continue to grow in the next 35 years. At around 0.34, China witnessed its lowest dependency ratio in 2010, which indicates that three workers were needed to support one dependent person (children aged 0−14 or elderly aged 65 and above). In 2050, the dependency ratio in China would grow to 0.67, indicating that three workers would support two dependent persons. Specifically, the increase in the dependency ratio that is projected for the next four decades is mainly due to the increase in the old-age dependency ratio, resulting from rapid population ageing in China. On the other hand, in the next future, the child dependency ratio would fluctuate between 0.20 and 0.25 only, thereby exerting a much smaller influence on the overall dependency ratio in the country. This finding is in stark contrast to the dependency ratios in the past several decades, which declined primarily due to the decrease in the child dependency ratio, which was caused by the rapidly decreasing fertility rates.

In the next four decades, the labour force in China would decrease both in size and proportion of the total population, under the assumption of constant labour force participation rates in 2010. By 2045, the labour force in China would reach 700 million workers, decreasing by about 100 million compared to the 2016 figure. The declining labour force supply in China suggests that the old economic development strategy that was primarily reliant on exports of low-cost products and labour-intensive industries cannot be sustained. At present, China is experiencing an economy in transition, which requires the policy makers and businesses to seek

appropriate and efficient solutions for these unprecedented changes and challenges. It should also be recognised that the great achievements in education could largely improve the skills and technical capability of Chinese labour force, which might lead to greater human capital accumulation and productivity, thus promoting sustainable economic growth, even though the labour force will decline in number and will age in composition in the future. Based on the population census data in China, the proportion of labour force with college and higher education increased from 4.66% to 11.06% between 2000 and 2010 (NBS, 2012). The number of Chinese citizens with college degree and above per 100,000 persons reached 8,930 in 2010, increasing from 1,422 in 1990 and 3,611 in 2000, which also suggests the significant development in education in China.

China's economy is experiencing a crucial transition, which would significantly affect the country's future, and may result in falling into or leaping over the middle-income trap. As the essential production input, the labour force supply in the future will continue to play an important role in the economic growth. As part of the study reported in this thesis, the challenges, opportunities and demographic changes of labour force supply in China in next four decades were investigated. The findings suggest that the Chinese economy would face a declining and ageing labour force in the next four decades, resulting from the rapid population ageing process. In addition to the negative effects of ageing on the labour force participation rates and productivity, some opportunities will also emerge. Population ageing would inspire the government and households to invest more into human capital, which might provide additional impetus for long-term sustainability of the economic growth in China. Consequently, the economy in China would be confronted with both challenges and opportunities caused by the changing labour force in the future. The findings reported in this thesis provide relevant

evidence and policy implications for the government and policy makers. To seize the opportunities and successfully complete the economic transition in the country, the Chinese government should gradually restructure the country's economy, and focus on changing the development strategy from a labour-intensive and export-dependent one to a technology-driven one. In addition, China should continue to dedicate efforts and resources to increasing domestic consumption, which might further boost its economy in the future.

6.1.3 Population ageing and household savings

Chapter 4 was dedicated to the analysis of effects of ageing on household savings using both macro- and micro-level data.

Over the past three decades, savings rates in China were exceptionally high, which is argued to be contributed by the rapid income growth following the economic miracle, intensive propensity to save, inequality in income distribution and uncertainties regarding income in the future (Chen et al., 1999; Peng, 2006; Ai, 2008; Su and Liao, 2010). In this context, the importance and significance of population age structure in household saving decisions has long been recognised by the researchers and policy makers alike (Leff, 1969; Horioka, 1991; Lindh, 1999; Lindh and Malmberg, 1999; Deaton and Paxson, 2000; Lee et al., 2000; Horioka, 2010). In this chapter, an overall analysis of the growing savings rate and population ageing in China was presented, and the findings and discussions reported within highlight the impacts of demographic factors on household saving decisions based empirical evidence from both macro and micro perspective.

As was shown in Chapter 4, the increasing old-age dependency ratio exhibited a significant positive relationship with the household savings rate during 1997−2010 in China, signifying that the growing dependency burden of supporting the elderly would increase the aggregated

savings rate going forward. However, the macro-level analysis also revealed that the elderly population growth rate is strongly and negatively associated with the savings rate, which implies that the rapid ageing process will probably reduce the aggregated savings rate in the country. During the period of analysis, the ageing process was relatively slow, allowing its effects on the household savings rate to be offset by the positive effects of other socio-economic and cultural factors. However, China is facing an accelerating ageing process in the forthcoming decades, as it is projected that the number of individuals aged 65 and above will exceed 200 million and their proportional contribution to the total population will increase to 14% in 2025. This unprecedented rate of population ageing in the country would play an increasingly important and adverse role in household savings, which would challenge the realisation of the second demographic dividend in China.

Moreover, the macro-level analysis results revealed two mechanisms through which population ageing affects household savings, one of which is manifested though the ageing in the population, and the other is exerted through the changing dependency burden. As part of the further investigation on the rationale behind the link between ageing and household savings, further analysis was conducted using micro-level data from the China Families Panel Studies in 2011. The micro-level analysis commenced with the Binary Logistic Regression Model to examine the influence of ageing on the household saving decisions, which were measured by the survey participants' response to the question whether they saved any money in the preceding year. The findings suggest that, while the ageing householders are less likely to save money, supporting elderly parents (especially parents aged 85 and above) would increase the probability of saving for the Chinese households. Furthermore, the relationship between ageing and amounts of household savings in China were examined, as this link is directly associated

with the capital accumulation. Based on the HLM results, as the age of householders in China increases while the amount of household savings declines, which further supports the premise that ageing is inversely related to the level of household savings. It is also interesting to note that, even though supporting the elderly would prompt the households to save money, having elderly parents would reduce the amount of household savings in China. In this context, findings further revealed that this relationship is dependent on the age of the oldest parent. If he/she is aged 85 and above, the Chinese household actually increases the savings, which might be due to the growing precautionary savings and inadequate old age pension provision by the state.

Another important finding reported in this chapter pertains to the effects of raising children aged 0−14 on household savings. In the Chinese households, parents prefer to save money for the children' education, housing purchase, and marriage in the future. The micro-level analysis reported in this chapter confirms the presence of a significant positive relationship between having children aged 0−14 and household savings. Specifically, raising children would significantly increase both the probability of saving money and the amount of household savings in China.

It was further shown that social welfare system also significantly affects the household savings in China. The model results revealed that the coverage ratio of social endowment insurance system has a significant and negative effect on the household savings rate, which indicates that a poorly developed social endowment system would inspire households to increase savings as a precautionary measure due to the uncertainties associated with the old-age life. The social welfare system could substitute the family's traditional function of supporting the elderly, and consequently reduce the household precautionary savings. However, the Chinese government should balance its fiscal expenditure on social welfare and economic

growth, as this may mitigate some issues associated with an increasingly growing old population, thereby avoiding the welfare trap in the future.

6.1.4 Population ageing and household consumptions

In Chapter 5 of this thesis, the relationship between population ageing and household consumption was examined from both macro and micro perspective. Using a GMM model based on provincial panel data, published by the National Bureau of Statistics of China, the effects of population ageing, measured by the old-age dependency ratio and the elderly population growth rate, on the household average propensity of consumption were examined. The macro-level analysis results revealed that the increasing old-age dependency ratios exert a significant negative effect on household average propensity to consume. Comparatively, the elderly population growth rate exhibits a much stronger relationship with household consumption during the same period. These findings suggest that population ageing would be negatively associated with the domestic consumption rates in China.

To further understand the effects of population ageing on household consumption, and elucidate the mechanisms through which ageing affects household consumption, HLM models were developed using micro-level data sourced from the China Family Panel Studies survey. The HLM models based on micro-level survey data provided insight into the relationship between ageing and consumption within households, which incorporate with multilevel variables, including those at the household-, community-, and province-level. The results revealed that the province-level variables included in the model explain about 17% of total variance in household consumption, while the community-level and household-level variables explain about 24% and 59% variance, respectively. The model results show that ageing within households, as measured by the average age of householder, exerts a significant negative effect

on household consumption per capita. If the average age of householder increased by one year, the household consumption per capita would decrease by 1.0%. These findings support the conclusion drawn from the macro-level data analysis, which suggested that population ageing would reduce household consumption. In addition, having children aged 0−14 would also negatively affect the household consumption per capita in China, probably resulting from increasing precautionary savings designated for children's education.

In Chapter 5, the effect of supporting elderly parents on household consumption was also examined using the micro-level survey data. The model results revealed that having elderly parents would increase the household consumption per capita in China, which would be affected by elderly mothers' age and education. Specifically, within households having elderly parents, elderly mother's age presents a negative association with the household consumption per capita. These findings suggest that supporting elderly parents hurts the welfare of the households, which is due to the stronger effect of precautionary savings and bequest motives along with an ageing population. Moreover, elderly mothers' education is positively associated with the household consumption per capita, due to higher economic and social status of old mothers with high educational attainment.

In addition to household consumption rates and household consumption per capita, the impact of ageing on household consumption structure was also examined in Chapter 5 using macro-level data. The findings suggest a significant effect of ageing on the structure of goods and services households consume. While the consumption of and demand for medical care and household services would increase, household expenditure on food and clothing would decrease. In addition, it should be particularly recognised that intergenerational differences in consumption structure should be considered in future research.

6.2 Implications and reflections

The findings reported in this thesis have both theoretical and practical implications in the fields of population ageing and Chinese economic studies.

The theories such as life cycle theory (LCT) pertaining to savings and consumption originated in the Western countries and have been widely applied to explain the economic experiences in the West, while taking demographic factors into consideration. The evidence-based analyses reported in this thesis extended the application of the LCT in China's case and improved the understanding of population ageing and the key elements in economy in a society that has experienced rapid and profound changes, thus contributing to the pertinent literature. As China is experiencing rapid population ageing and its economy is in transition, it was essential to explore the relationship between population ageing and country's economic growth, which bears some unique characteristics due to its institutional, cultural and political backgrounds. With the empirical evidence provided by both macro- and micro-level analysis, the study contributes to a better understanding of the role of population ageing in household savings and consumption behaviour in China. This thesis has examined the impacts of ageing on household savings rate and consumption, utilising the old-age dependency ratio and the old population growth rate as a joint measure of ageing. The results revealed negative and strong effects of ageing on household consumption, thus challenging the applicability of Life Cycle Theory in China's case. This incongruence is attributed to the traditional role of families in China, whereby all members are supposed to support one another. The micro-level analysis of the effects of ageing population on household savings revealed that older average age of householder would decrease both the probability and amount of household savings, which suggests negative impact of ageing on household savings. Supporting elderly parents would

increase the likelihood that Chinese households save for the future, but would reduce the amount saved. The analyses in this thesis as noted earlier, extend the application of the Life Cycle hypothesis in China, and provide evidence in support of the viewpoint that old-age dependency burden positively affects the savings rate. However, they also counter this theory by revealing a negative association between supporting the elderly and the amount of household savings in China.

In addition to theoretical significance, the findings in this study have some important practical implications as well, as they provide insights into potential policy reforms, including fertility policy adjustments, population plans, economic restructuring, and social security policy reforms. The findings reported in this thesis suggest a temporary but significant effect of the two-child policy on fertility rates and the number of births per annum, which indicates that the Chinese government should make appropriate changes in its population plans, including providing more childcare services. However, it should be particularly noted that the increase in the number of births per annum is temporary, which indicates that the large-scale construction of kindergartens and children's hospitals would not be recommended due to low long-term utility.

Moreover, the demographic future in China under the two-child policy suggests that the population will continue to age, due to which the country's labour force will decrease and the dependency ratio will increase. Both of these factors will have unprecedented and profound implications for the economy and society. The old development strategy that is largely dependent on labour-intensive industries and large amounts of government-led investments is challenged by the changing demographic conditions. This thesis provides evidence-based findings that will contribute to the evaluation and formulation of further economic reforms that

can address the challenges brought by rapid population ageing. The Chinese government is advised to implement effective economic reforms to ensure the sustainability of economic growth and enhance the country competitiveness in the future, including but not limited to boosting its domestic consumption, promoting technology- and innovation-driven improvements, and reducing the dependence on low-cost product exports.

In addition, the empirical analysis on the impacts of ageing on household savings and consumption revealed the relationship between ageing and household economic behaviour. Population ageing would affect household savings and consumption through two mechanisms, one of which is exerted through the negative effect of increasing average population age on household savings and consumption, while the other is exhibited through the complex and interrelated effects of supporting the elderly on household economic behaviours. The findings reported in the preceding chapters suggest that the population ageing would continue to negatively affect the household savings and consumption, and this effect will strengthen as the ageing process accelerates in the future. In particular, supporting the elderly was shown to exert significant effects on household economic behaviours, and thus on the macro economy and the society in China. Against this background, it is essential to address the importance of the social security system in the country, which is presently far from adequately developed, as indicated by the expanding gap in national pension account, low coverage in rural areas, financing issues in social security fund, institutional division in management, and lack of top-level initiative and legislation. In the context of a rapid ageing process, it is sensible to suggest that the Chinese government needs urgently act to improve the country's social security system, and respond to the challenges of increasing dependency burden together with households, especially those residing in rural areas.

6.3 Future Research

The aim of the study reported in this thesis is to analyse and project the demographic future in China under the two-child policy, which was achieved by examining the impacts of ageing on labour force supply, household savings and consumption. The population, the economy and the society in China have been undergoing changes and transitions for several decades and will have profound implications for the country's future. Against this background, the author of this thesis attempted to investigate the relationships and interactions among these crucial elements in the country. This study provides a valuable insight into the effects of ageing on macro economy in China, in terms of labour force supply, and household savings and consumption. However, more extensive research on these phenomena is needed in this field.

In particular, it would be fruitful to conduct studies on the topic of the human capital accumulation in China in the context of changing labour force supply in China. In the present study, the labour force supply in the country was investigated from demographic perspective, without consideration for the human capital accumulation in China. Given the great improvements in education attainment and skill base in the country, using the number of employed individuals is inadequate for measuring the human capital resources in China, which is crucial for sustaining the economy in transition. Moreover, the demands for labour force among industries and occupations will be changing in the future, owing to the global changes and the restructuring of Chinas economy. These issues are presently not adequately understood and further studies are highly recommended.

Considering the traditional culture and social system in China, the family has been shouldering the responsibility of not only raising young children but also supporting the elderly. This indicates that the intergenerational wealth transfer plays a significant role in Chinese

households' wealth and economic behaviour. The analyses reported in this thesis did not address this aspect, which should be particularly emphasised in the future studies.

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Appendix A

Assumptions of total fertility rates, sex ratio at birth, and life expectancy at birth for the population projections in Chapter 2.

Year	TFR				SRB	Life expectancy	
	One-child Policy	High Scenario	Middle Scenario	Low Scenario		Male	Female
2016	1.50	1.50	1.50	1.50	114	73.48	78.47
2017	1.50	1.99	1.87	1.74	114	73.66	78.65
2018	1.49	2.31	2.10	1.90	113	73.84	78.83
2019	1.49	2.42	2.19	1.96	113	74.02	79.01
2020	1.49	2.44	2.21	1.97	112	74.20	79.19
2021	1.48	2.20	2.02	1.85	112	74.38	79.37
2022	1.47	2.08	1.93	1.79	111	74.56	79.55
2023	1.47	1.88	1.78	1.69	111	74.74	79.73
2024	1.46	1.84	1.76	1.67	110	74.92	79.91
2025	1.45	1.78	1.71	1.64	110	75.10	80.09
2026	1.45	1.75	1.68	1.62	109	75.22	80.21
2027	1.44	1.74	1.68	1.62	108	75.34	80.33
2028	1.43	1.74	1.68	1.62	107	75.46	80.45
2029	1.43	1.74	1.68	1.62	107	75.58	80.57
2030	1.42	1.74	1.68	1.62	107	75.70	80.69
2031	1.42	1.74	1.68	1.62	107	75.82	80.81
2032	1.41	1.74	1.68	1.62	107	75.94	80.93
2033	1.41	1.74	1.68	1.62	107	76.06	81.05
2034	1.40	1.74	1.68	1.62	107	76.18	81.17
2035	1.40	1.74	1.68	1.62	107	76.30	81.29
2036	1.40	1.74	1.68	1.62	107	76.42	81.41
2037	1.40	1.74	1.68	1.62	107	76.54	81.53
2038	1.40	1.74	1.68	1.62	107	76.66	81.65
2039	1.40	1.74	1.68	1.62	107	76.78	81.77
2040	1.40	1.74	1.68	1.62	107	76.90	81.89
2041	1.40	1.74	1.68	1.62	107	77.02	82.01
2042	1.40	1.74	1.68	1.62	107	77.14	82.13
2043	1.40	1.74	1.68	1.62	107	77.26	82.25
2044	1.40	1.74	1.68	1.62	107	77.38	82.37
2045	1.40	1.74	1.68	1.62	107	77.50	82.49
2046	1.40	1.74	1.68	1.62	107	77.60	82.61
2047	1.40	1.74	1.68	1.62	107	77.70	82.71
2048	1.40	1.74	1.68	1.62	107	77.80	82.81
2049	1.40	1.74	1.68	1.62	107	77.90	82.91
2050	1.40	1.74	1.68	1.62	107	78.00	83.01

Appendix B

The detailed calculation results of the contribution of ageing to the declining overall labour force participation rate during 2000-2010 in Chapter 3.

Age	Labour force participation rate (%)		Population (thousand)		$P^{adj}_{aged\ x\ in\ 2010}$	LF^{e}_{2010}
	2000	2010	2000	2010		
16	39.59	15.29	18,900	17,458	22,212	3,396
17	52.72	26.65	18,235	18,901	21,431	5,712
18	64.19	39.99	20,535	18,880	24,134	9,651
19	73.69	50.11	16,756	19,419	19,693	9,868
20	81.09	58.38	15,776	25,412	18,541	10,824
21	85.31	65.72	16,537	24,037	19,435	12,772
22	89.04	74.60	16,464	22,372	19,349	14,434
23	91.28	82.20	15,856	23,437	18,635	15,317
24	91.81	85.86	18,101	20,786	21,274	18,266
25	91.95	87.56	18,623	18,256	21,887	19,165
26	92.10	88.55	20,414	18,073	23,992	21,244
27	92.22	89.10	21,282	17,846	25,012	22,285
28	92.46	89.45	22,419	20,619	26,348	23,567
29	92.69	89.76	23,176	17,989	27,238	24,450
30	92.82	89.90	25,501	17,489	29,971	26,943
31	92.90	90.07	23,205	18,300	27,272	24,564
32	93.07	90.14	25,738	18,041	30,248	27,266
33	93.25	90.28	20,358	16,910	23,926	21,601
34	93.35	90.41	23,462	19,253	27,574	24,930
35	93.26	90.51	23,370	19,825	27,466	24,860
36	93.25	90.62	22,920	21,511	26,937	24,409
37	93.23	90.71	26,656	22,504	31,328	28,417
38	93.26	90.85	19,996	23,367	23,501	21,351
39	92.77	90.99	10,929	23,788	12,845	11,688
40	92.19	90.88	14,005	26,079	16,460	14,959
41	92.14	90.79	12,639	23,608	14,854	13,486
42	92.17	90.78	16,588	25,722	19,496	17,698
43	92.05	90.70	18,504	20,345	21,748	19,725
44	91.51	90.40	16,957	23,058	19,929	18,016
45	90.53	89.45	18,195	22,979	21,384	19,127
46	89.37	88.38	18,109	22,446	21,283	18,810
47	88.31	87.46	16,435	25,932	19,316	16,893
48	87.28	86.76	16,887	19,414	19,847	17,219
49	85.58	84.46	14,163	10,828	16,645	14,058

50	82.53	78.90	14,266	13,769	16,766	13,229
51	80.84	77.26	13,805	12,279	16,225	12,536
52	79.34	76.30	11,829	16,208	13,902	10,607
53	77.38	75.61	11,534	17,858	13,555	10,249
54	75.56	74.21	10,646	16,474	12,512	9,285
55	72.70	71.09	9,842	17,352	11,567	8,223
56	70.60	68.66	9,563	17,453	11,239	7,717
57	68.02	67.17	8,677	15,840	10,198	6,850
58	65.01	65.35	8,705	15,982	10,231	6,686
59	62.24	62.19	8,808	13,487	10,352	6,438
60	55.67	53.98	8,949	13,598	10,518	5,678
61	51.80	51.38	7,453	12,891	8,760	4,500
62	49.64	49.14	8,482	11,229	9,968	4,898
63	47.51	46.73	7,980	10,677	9,379	4,383
64	45.19	44.42	8,083	9,925	9,499	4,219
65+	25.06	21.10	87,035	118,267	102,289	21,578

The expected labour force in 2010 (thousand)	754,045
The adjusted population aged 16 and above in 2010 (thousand)	1,038,171
The standardised overall labour force participation rate in 2010 (%)	72.63
The observed overall labour force participation rate in 2000 (%)	77.99
The observed overall labour force participation rate in 2010 (%)	70.96
The contribution of ageing (%)	23.8

Appendix C

The data and calculations for analysing the impact of ageing on the economic growth during the period of 2000-2010 in Chapter 3.

Year	L (million)	Y (billion *yuan*)	K (billion *yuan*)
2000	720.85	5,060.8	4,993.7
2001	727.97	5,480.9	5,596.7
2002	732.80	5,979.6	6,272.5
2003	737.36	6,577.6	7,029.9
2004	742.64	7,241.9	7,878.8
2005	746.47	8,060.2	8,830.1
2006	749.78	9,083.9	9,896.4
2007	753.21	10,373.8	11,091.4
2008	755.64	11,369.7	12,430.7
2009	758.28	12,415.7	13,931.8
2010	761.05	13,731.8	15,614.1

The output elasticity coefficient of labour force α	0.79
The output elasticity coefficient of capital $(1-\alpha)$	0.21
The contribution of labour force in economic growth (%)	14.0
The contribution of capita in economic growth (%)	52.7
The contribution of technology in economic growth (%)	33.3
The influence of declining in young labour force (%)	-1.3

Appendix D

The detailed calculation steps for Grey Related Analysis in Chapter 5.

a) Standardize data transformation for both compared series and referential series

Y1=(1.00，0.98，0.98，0.97，0.94，0.89，0.86，0.85，0.83，0.81，0.73)

Y2=(1.00，1.00，1.00，1.00，1.01，1.03，1.03，1.03，1.04，1.04，1.06)

Y3=(1.00，1.02，1.05，1.08，1.09，1.10，1.14，1.16，1.19，1.22，1.27)

X1=(1.00，0.97，0.96，0.94，0.96，0.93，0.91，0.92，0.96，0.93，0.90)

V2=(1.00，1.00，0.98，0.98，0.95，1.01，1.04，1.04，1.04，1.05，1.07)

X3=(1.00，1.02，0.92，0.95，0.90，0.90，0.92，0.87，0.90，0.89，0.87)

X4=(1.00，0.95，0.86，0.84，0.76，0.75，0.76，0.80，0.82，0.86，0.90)

X5=(1.00，1.02，1.12，1.15，1.16，1.19，1.12，1.10，1.10，1.10，1.02)

X6=(1.00，1.09，1.22，1.30，1.38，1.47，1.54，1.59，1.47，1.61，1.72)

X7=(1.00，1.04，1.12，1.07，1.07，1.03，1.03，0.99，0.90，0.90，0.90)

X8=(1.00，1.02，0.94，0.96，0.97，1.02，1.04，1.04，1.08，1.13，1.08)

b) Calculate the absolute difference between two series,

ΔY1X1=(0.00，0.01，0.02，0.02，0.02，0.04，0.04，0.07，0.13，0.12，0.18)

ΔY1X2=(0.00，0.02，0.00，0.01，0.02，0.12，0.17，0.19，0.21，0.24，0.35)

ΔY1X3=(0.00，0.03，0.06，0.02，0.04，0.01，0.06，0.02，0.07，0.08，0.15)

ΔY1X4=(0.00，0.04，0.12，0.12，0.18，0.14，0.10，0.04，0.01，0.05，0.17)

ΔY1X5=(0.00，0.03，0.14，0.18，0.22，0.30，0.26，0.25，0.27，0.29，0.29)

ΔY1X6=(0.00，0.11，0.24，0.33，0.44，0.58，0.68，0.74，0.65，0.80，1.00)

ΔY1X7=(0.00，0.05，0.14，0.11，0.13，0.15，0.17，0.14，0.07，0.09，0.18)

ΔY1X8=(0.00，0.04，0.03，0.00，0.03，0.13，0.17，0.19，0.25，0.32，0.35)

ΔY2X1=(0.00，0.04，0.05，0.06，0.05，0.10，0.12，0.11，0.08，0.12，0.16)

ΔY2X2=(0.00，0.00，0.02，0.03，0.06，0.02，0.00，0.01，0.00，0.00，0.01)

ΔY2X3=(0.00，0.01，0.09，0.05，0.11，0.13，0.11，0.16，0.14，0.16，0.19)

ΔY2X4=(0.00，0.06，0.14，0.16，0.25，0.28，0.27，0.23，0.22，0.18，0.16)

ΔY2X5=(0.00，0.01，0.12，0.15，0.14，0.16，0.09，0.06，0.06，0.06，0.05)

ΔY2X6=(0.00，0.09，0.21，0.29，0.36，0.44，0.51，0.56，0.44，0.56，0.66)

ΔY2X7=(0.00，0.03，0.11，0.07，0.06，0.00，0.00，0.04，0.14，0.14，0.16)

ΔY2X8=(0.00，0.02，0.06，0.04，0.04，0.01，0.00，0.01，0.04，0.08，0.02)

ΔY3X1=(0.00，0.05，0.09，0.14，0.13，0.17，0.23，0.24，0.22，0.29，0.37)

ΔY3X2=(0.00，0.05，0.09，0.14，0.13，0.17，0.23，0.24，0.22，0.29，0.37)

ΔY3X3=(0.00，0.00，0.13，0.13，0.19，0.20，0.22，0.29，0.28，0.33，0.40)

ΔY3X4=(0.00，0.07，0.19，0.24，0.33，0.35，0.37，0.35，0.36，0.36，0.37)

ΔY3X5=(0.00，0.00，0.07，0.07，0.07，0.08，0.02，0.06，0.09，0.12，0.26)

ΔY3X6=(0.00，0.07，0.17，0.22，0.29，0.36，0.41，0.43，0.29，0.39，0.45)

ΔY3X7=(0.00，0.02，0.07，0.01，0.02，0.07，0.11，0.16，0.28，0.32，0.37)

ΔY3X8=(0.00，0.00，0.10，0.12，0.12，0.09，0.10，0.12，0.10，0.09，0.20)

Then maximum and minimum differences are found.

$Max(\Delta Y_1X_k) = 1.00$

$Max(\Delta Y_2X_k) = 0.66$

$Max(\Delta Y_3X_k) = 0.45$

$Min(\Delta Y_jX_k) = 0.00$, where $j = 1, 2, 3$; $k = 1, 2 \ldots 8$

c) Calculate the relational coefficient e(ΔYjXk).

e(ΔY1X1)=(1.00，0.97，0.96，0.95，0.97，0.92，0.92，0.87，0.79，0.81，0.74)

e(ΔY1X2)=(1.00，0.96，1.00，0.98，0.97，0.80，0.74，0.72，0.71，0.68，0.59)

e(ΔY1X3)=(1.00，0.94，0.89，0.97，0.93，0.97，0.90，0.96，0.87，0.86，0.77)

e(ΔY1X4)=(1.00，0.93，0.81，0.80，0.73，0.79，0.84，0.92，0.99，0.91，0.74)

e(ΔY1X5)=(1.00，0.94，0.78，0.73，0.70，0.62，0.66，0.67，0.65，0.63，0.63)

e(ΔY1X6)=(1.00，0.82，0.68，0.60，0.53，0.46，0.42，0.40，0.44，0.38，0.33)

e(ΔY1X7)=(1.00，0.90，0.78，0.83，0.79，0.77，0.75，0.78，0.87，0.85，0.74)

e(ΔY1X8)=(1.00，0.93，0.94，0.99，0.94，0.79，0.74，0.72，0.66，0.61，0.59)

e(ΔY2X1)=(1.00，0.90，0.88，0.84，0.86，0.77，0.73，0.74，0.81，0.74，0.68)

e(ΔY2X2)=(1.00，1.00，0.93，0.93，0.86，0.94，0.99，0.98，0.99，0.99，0.98)

e(ΔY2X3)=(1.00，0.96，0.79，0.86，0.75，0.72，0.75，0.67，0.71，0.68，0.64)

e(ΔY2X4)=(1.00，0.85，0.70，0.67，0.57，0.54，0.55，0.59，0.60，0.64，0.67)

e(ΔY2X5)=(1.00，0.96，0.74，0.70，0.70，0.67，0.78，0.84，0.85，0.86，0.88)

e(ΔY2X6)=(1.00，0.79，0.61，0.53，0.48，0.43，0.39，0.37，0.43，0.37，0.33)

e(ΔY2X7)=(1.00，0.91，0.74，0.83，0.84，0.99，1.00，0.89，0.71，0.70，0.67)

e(ΔY2X8)=(1.00，0.95，0.85，0.89，0.90，0.97，0.99，0.98，0.88，0.80，0.95)

e(ΔY3X1)=(1.00，0.81，0.71，0.62，0.63，0.56，0.49，0.49，0.50，0.44，0.38)

e(ΔY3X2)=(1.00，0.93，0.76，0.69，0.63，0.70，0.69，0.66，0.60，0.57，0.52)

e(ΔY3X3)=(1.00，0.99，0.63，0.64，0.55，0.52，0.51，0.44，0.44，0.40，0.36)

e(ΔY3X4)=(1.00，0.75，0.54，0.49，0.40，0.39，0.38，0.39，0.38，0.38，0.37)

e(ΔY3X5)=(1.00，0.98，0.76，0.76，0.77，0.73，0.93，0.79，0.72，0.65，0.47)

e(ΔY3X6)=(1.00，0.77，0.57，0.51，0.44，0.38，0.36，0.34，0.44，0.37，0.33)

e(ΔY3X7)=(1.00，0.94，0.77，0.97，0.93，0.75，0.68，0.58，0.44，0.41，0.38)

e(ΔY3X8)=(1.00，0.99，0.68，0.66，0.66，0.72，0.69，0.66，0.69，0.71，0.54)

d) Calculate the relational degree matrix.

$$r = \begin{bmatrix} 0.90, 0.83, 0.91, 0.86, 0.73, 0.55, 0.82, 0.81 \\ 0.81, 0.96, 0.78, 0.67, 0.82, 0.52, 0.84, 0.92 \\ 0.60, 0.70, 0.59, 0.50, 0.78, 0.50, 0.71, 0.73 \end{bmatrix}$$

Appendix E

China Family Panel Studies (2010)

Village / Residential Community Questionnaire (selected questions)

Part A:

A0 The interviewer records whether the current location is in a village or a residential community.

1. Residential Community (*Ju wei hui*) 5. Village (*Cun wei hui*)

Part Z:

Interviewer Note: Complete the following questions through observation without interviewing the respondent.

Z1 Economic condition of the village/residential community:

Very poor --1--2--3--4--5--6--7--〉Very rich

Z2 Cleanliness of the roads in the village/residential community:

Very dirty--1--2--3--4--5--6--7--〉Very clean

Z3 Outlook of the members in the village/residential community:

Very negative--1--2--3--4--5--6--7--〉Very positive

Z4 Socioeconomic homogeneity among the people in the village/residential community:

Very diverse --1--2--3--4--5--6--7--〉Very similar

F1: "Homogeneity" means that the social-economic situation varies little among the residents of the community.

Z5 Architectural layout of the village/residential community;

Disorderly --1--2--3--4--5--6--7--〉Very tidy

Z6 Spaciousness of the village/residential community;

Crowded --1--2--3--4--5--6--7--〉Spacious

Z7 Type of village/residential community:

Interviewer Note: distinguish between town and suburb.

1. City *[Skip to Z701]* 2. Town *[Skip to Z702]*

3. Rural village *[Skip to Z703]* 4. Suburb *[Skip to Z901]*

F1: (1) "City" usually refers to the densely-populated area of a designated city, such as the downtown of a county- or prefect-level city.

(2) "Town" usually refers to the area where the government of a designated county or township is located.

(3) "Rural village" usually refers to an area populated by people who mainly participate in agricultural work and is structured in the form of a village.

(4) "Suburb" usually refers to the periphery of a city with high population density that is part of a designated city in terms of administration.

Family Member Questionnaire

1. Co-Resident Family Members (Table T1)

Person Code								
101								
102								

301								
302								

*F1: (1) Members coded as "1**" are those related through blood/marriage/ adoption, including parents-in-law/ stepparents/ nephews/ nieces/ grandchildren, etc. They should also be listed in Table T2 and may be interviewed with individual questionnaires.*

*(2) Members coded as "3**" are those not related through blood/marriage/ adoption, such as housekeepers, drivers, day laborers, or other short-term temporary residents. They should not be listed in Table T2, and will not be interviewed individually.*

Confirm the respondent who reported the family member roster:

A1 Do you live together with the other members of this family?

1. Yes *[Skip to A2]* 5. No *[Continue on]*

F1: "Live together" means that family and non-family members are economically related, including blood/relative relationship members and non- relative members, such as housekeepers, drivers or distant relatives who work as housekeepers.

A101 Is your family a single-person family?

1. Yes *[Skip to A201]* 5. No *[Choose another member to interview]*

F1: "Single-person family" means a family unit with only one person.

[CAPI] If A101=5, go back to A1.

A2 Do you have a blood/marital/adoptive relationship with anyone in this family?

1. Yes *[Continue]* 5. No *[Choose another member to interview]*

[CAPI] If A2= 5, go back to A1.

A201 Your name is _____

[CAPI] If A101=1, skip to B1.

A3 How many people besides yourself are currently living together in this family?____

Interviewer Note: People of the following 7 types who are economically connected to the family should be counted as "living together in this house". Check with the respondent to make sure these people are counted.

1. Study away from hometown 2. Out-migration for work/Work away from hometown 3. Monk 4. Visit friends/relatives 5. In prison 6. Military service

7. Abroad (Including Hong Kong, Macao, and Taiwan)

F1: "Live together" means that family and non-family members are economically related, including blood/relative relationship members and non-relative members, such as housekeepers, drivers or distant relatives who work as housekeepers.

A4 How many people besides yourself living together in this family have lineal blood/marriage/adoptive relationships with you? _____

Interviewer Note: this question is judged by the actual situation and does not require asking the respondent.

F1: "Lineal relationships" should include the following: 1) Students studying away from hometown; 2) Children in active military service; 3) Economically connected family members who migrate for work.

A401 List the names of the people who live together in the family and also have lineal

blood/marriage/adoptive relationships with you and your family members:

_____,_____,_____

A5 How many of the family members are non-lineal/collateral relatives? _____

Interviewer Note: this question is judged by the actual situation and does not require asking the respondent.

F1: "Non-lineal/collateral relative" means parents-in-law/grandparents-in-law/ nephews/nieces/cousins, etc. The adopted children are lineal relatives.

A501 Among those "Number in A5" who have blood/marriage/adoptive relationships with you and your family members, but are non-lineal/collateral relatives, how many have been living in your family for 3 months or more? _____

F1: "Non-lineal/collateral relative" means parents-in-law/grandparents-in-law/ nephews/nieces/cousins, etc. The adopted children are lineal relatives.

A502 What are the names of these people who live together in your family, have blood/marriage/adoptive relationships with you and your family members, but are non-lineal/collateral relatives? _____,_____,_____

A6 Among the people living together in your family, how many of them do not have blood/marriage/adoptive relationships with you and your family members? _____

Interviewer Note: this question is judged by the actual situation and does not require asking the respondent.

A601 Among those "Numbers of A6" who do not have blood/marriage/adoptive relationships but are living together in this family, how many have been living here for at least 6 months? _____

A602 What are their names? _____

B1 Date of birth of "family member's name"?

____ year ____ month ___ day; Chinese Zodiac _____; Age ____

Interviewer Note: (1) Use YYYY/MM/DD format.

(2) If either the month or the day of birth is unknown, enter "CTRL-D".

(3) If none of the year, month, and day of birth, but age is known, enter "CTRL-D" and record age and Chinese Zodiac.

B2 "Family member's sex:

1. Male 5. Female

B3 "Family member's" marital status: *[List of marital status] [Show card]*

1. Never married 2. Married 3. Cohabitation 4. Divorced 5. Widowed

B4 "Family member's" highest level of education completed *[List of levels of education]*

Interviewer Note: If the respondent has not completed primary school, record "1. Illiterate/Semi-literate".

1. Illiterate/Semi-literate 2. Primary school 3. Middle school

4. High school 5. 2- or 3-year college 6. 4-year college/Bachelor's degree 7. Master's degree 8. Doctoral degree

B5 "Family member's" primary occupation _____

Interviewer's Note: (1) If more than one occupation, record the one that takes the most of the time; (2) If unemployed, record "-8 Not applicable"; (3) Record detailed information on occupation, such as department, job responsibility, position, and title.

Examples:

Chinese language teacher and grade leader of ×× Primary School

Accountant of ××Company

Director of xx workshop at ××Factory

Nurse from xx hospital in ××County

Farmer who grows rice in the local village

B501 Does the "family member" holds an administrative/management position?

1. Yes 5. No *[Skip to B6]*

B502 What is "family member's" administrative/management position?_____

Interviewer's Note: Record the position in details.

B6 Is "family member" currently living in this family?

Interviewer Note: Short-term absences (will be back in 3 months and live in the family in the long term) should be treated as living in this family.

1. Yes *[Skip to next family member]* 5. No *[Continue]*

B601 Why is the "family member" currently not living here?

Interviewer Note: If studying abroad, record 7.

1. Study away from hometown 2. Out-migration for work/Work away from hometown 3. Monk 4. Visit friends/relatives 5. In prison 6. Military service 7. Abroad (Including Hong Kong, Macao, and Taiwan).

2. Relationship table for the lineal family members who live together (Table T2)

Person code	Name	Father	Mother	Spouse	Child1	Child2	Child3	Child4	Child5	Child6
101										
102										

C1 Who is “family member’s” father? _____

C2 Who is “family member’s” mother? _____

C3 Who is “family member’s” spouse? _____

C4 Who is “family member’s” child/children? _____

3. Information on the lineal family members who do not live together (Table T3)

Person Code										
201										
202										

D1 Date of birth of “the lineal family member who does not live together”:

_____year _____ month _____day, Chinese Zodiac _____, Age _____

Interviewer Note: (1) Use YYYY/MM/DD format; (2) If either the month or the day of birth is unknown, enter “CTRL-D”; (3) If none of the year, month, and day of birth, but age is known, enter “CTRL-D” and record age and Chinese Zodiac.

D2 “the lineal family member who does not live together” sex:

1. Male 5. Female

D3 Is “the lineal family member who does not live together” still alive?

1. Yes *[Continue]* 5. No *[Continue to next family member not living together]*

D4 Marital status of “the lineal family member who does not live together” *[List of marital status] [Show card]*

1. Never married 2.Married 3. Cohabitation 4. Divorced 5. Widowed

D5 The highest level of education of “the lineal family member who does not live together”

[List of levels of education]

Interviewer Note: If the respondent has not completed primary school, record “1. Illiterate/Semi-literate”.

1. Illiterate/Semi-literate 2. Primary school 3. Middle school

4. High school 5. 2- or 3-year college 6. 4-year college/Bachelor’s degree

7. Master’s degree 8. Doctoral degree

[CAPI] If “family member” is under the age of 16, skip to D7.

D6 Occupation of” the lineal family member who does not live together” _____

Interviewer Note: (1) If more than one occupation, record the one that takes the most time;(2) If unemployed, record “-8 Not applicable”; (3) Record detailed information on the occupation, such as department, job responsibility, position, and title.

Examples:

Chinese language teacher and grade leader of ×× Primary School

Accountant of ××Company

Director of xx workshop at ××Factory

Nurse from xx hospital in ××County

Farmer who grows rice in the local village

[CAPI] Skip to D7 if D6= “-8”

D601 Does the “lineal family member who does not live together” hold an administrative/management position?

1. Yes 5. No *[Skip to D7]*

D602 What is the administrative/management position of the “lineal family member who does

not live together”? _____

Interviewer Note: Record the position in detail.

D7 Where is the “lineal family member who does not live together” currently living? *[List of living locations]*

1.Next door 2.Same village/street 3.Different village/street in the same county/district 4.Different county/district in the same prefecture-level city

5. Different city in the same province 6. Different province _____Province

7. Outside of Mainland China (including Hong Kong, Macao and Taiwan)

D8 Household registration of the “lineal family member who does not live together” is:

Interviewer Note: If the member’s nationality is not Chinese, then record “79-Not applicable”.

1. Agricultural 2. Non-agricultural 5. No registration 79. Not applicable

Family Questionnaire (selected questions)

Part D:

D1 The house in which your family is currently living is: *[Show card; select only one response]:*

1. Property right solely owned by the family *[Continue to D101]*

2. Joint property right with *danwei* (work unit) *[Skip to D110]*

3. Rented *[Skip to D120]* 4. Provided by the government for free *[Skip to D2]*

5. Provided by *danwei* for free *[Skip to D2]*

6. Provided by parents/children *[Skip to D2]*

7. Borrowed from friends or relatives *[Skip to D2]*

77. Other [Please specify] _____ *[Skip to D2]*

F1: (1) "Property right solely owned by the family" refers to the situation that the family has "the House Proprietary Certificate, Land Certificate, and the Contract Tax Payment Certificate". For rural families, self-built houses are treated as "property right solely owned by the family".

(2) "Joint property right with danwei" refers to the situation that the residents paid for part of the property rights and the danwei paid the rest. If the residents do not have a Land Certificate, it means that they have "Joint property right with danwei". Most of these houses are in the process of reform and the danwei reserves the Land Certificate, meaning "Joint property right".

Part E:

E1 Did anyone in your family leave home to work outside last year?

1. Yes 3. No *[Continue to E2]* 5. Not married yet last year *[Continue to E2]*

F1: (1) "Outside" means working in a place that is not where the person's household is registered or where the household's permanent address is. In rural areas, it usually refers to working in a different county. In urban areas, it usually refers to working in a different city. (2) "Work outside" means that people do not migrate permanently to work in a different county from where their families reside, as in the case of rural migrant workers.

[CAPI] If E1=1, skip to the [Work Outside Home Module], otherwise continue to E2.

E2 What type of government subsidy is your family entitled to? *[Select all that apply]*

1. Poor families receiving the basic living allowances [Continue to E201]

2. Relatives of a military member [Skip to E202]

3. Relatives of a martyr [Skip to E202]

4. Relatives of a disabled person *[Skip to E202]* 78. None of the above *[Skip to E3]*

E201 The main reason for your family's poverty is the following:

Interviewer Note: If there is more than one reason, please select the most important one.

1. Lack of labour force 2.Poor natural conditions or natural disasters

3. Disease or injury 4. Laid off/Unemployment

5. Failure in investment 77. Other *[please specify]*

E202 How many subsidies did your family receive from any level of government last year (including material goods and money)? _____yuan

E3 Is your family involved or partly involved in any non-agricultural industry?

1. Yes 5. No *[Continue to E4]*

[CAPI] If E3=1, skip to the [Non-Agricultural Business Module], otherwise continue to E4

E4 Did your family rent out houses last year?

1. Yes 5. No *[Skip to E5]*

F1: "Rent out" means rent the house to other people and receive a rental payment.

E401 The income from housing rent last year was_____ yuan

Interviewer Note: Record the actual income from renting out the house. If the house was rented out for only three months last year, record the rental income from those three months.

E5 Did your family rent out land or other means of production last year?

1. Yes *[Continue to E501]* 5. No *[Skip to E6]*

F1: "Means of production" refers to the products used for production and construction, including industrial and agricultural means of production.

E501 The total income from renting out land or other means of production last year was _____yuan.

E6 Did your family rent out other things last year?

1. Yes *[Continue to E601]* 5. No *[Skip to E7]*

E601 The income from renting out other things last year was _____yuan.

E7 Did your family sell any property (household items) last year?

Interviewer Note: Agricultural products do not count.

1. Yes *[Continue to E701]* 5. No *[Skip to E8]*

Interviewer Note: Don't count agricultural products.

E701 The total income from selling properties was _____yuan.

E8 Has your family ever experienced demolishment/relocation?

1. Yes *[Continue to E801]* 5. No *[Skip to E9]*

F1: "Demolishment/relocation" means that the development and construction unit demolishes the housing owned by citizens, legal persons or other organizations according

to urban planning approved by a certain administrative authority. The citizens, legal persons or other organizations should be compensated and relocated based on the open market price of their housing.

E801 In which year was the house demolished? _____

E802 The relocation compensation was _____yuan.

E9 Has any land owned by your family been requisitioned?

1. Yes *[Continue to E901]* 2. No *[Skip to F1]*

F1: "Land requisition" means that in the public interest, the government transfers the and collectively owned by the famers into state-owned land after providing group and individual compensation to the farmers according to the legal authorities and procedures. Land requisition is an important measure to ensure the land provision for constructing public and social welfare facilities.

E901 In which year was the land of your family requisitioned? _____

E902 What was the area of the requisitioned land? _____*mu*

E903 The compensation for requisitioned land was _____ *yuan*.

Part F:

F1 Did your family save money last year?

Interviewer Note: Regardless of whether or not the family had deposits at the end of last year, record "1"as long as the family deposited any money last year.

1. Yes 5. No

F2 The total amount of deposit at the end of last year was _____yuan

Interviewer Note: If there was no deposit, record "0".

F1 (In general term): "Deposit" refers to money saved in a bank or at other

organizations/by individuals that pay interest.

F1 (In technical term): "Deposit" is a credit activity in which banks or other credit institutions receive monetary capital and pay a certain amount of interest to the depositors based upon the property, type, and duration of the deposit. Here the amount of deposit should be a positive number, and do not distinguish different types of deposit when calculating interest. Ask for the total interest of the deposit.

[CAPI] If F2="0", skip to F3, otherwise continue to F201.

F201 Last year, the interest earned from your family's deposit was _____ yuan

F1 (In general term): "Deposit" refers to money saved in a bank or at other organizations/by individuals that pay interest.

F1(In technical term): "Deposit" is a credit activity in which banks or other credit institutions receive monetary capital and pay a certain amount of interest to the depositors based upon the property, type, and duration of the deposit. Here the amount of deposit should be a positive number, and do not distinguish different types of deposit when calculating interest. Ask for the total interest of the deposit.

F3 Did your family have any of the following financial products last year? *[Select all that apply]*

1. Stocks 3. Capital funds 5. Securities 78. None of these *[Skip to F4]*

F1 (In general term): "Stocks, capital funds and securities" refer to the portfolios/ securities purchased in a domestic or foreign stock market.

F1 (In technical term): (1) "Stock" means a certificate issued by the limited liability company which proves that the stockholder enjoys the benefits and takes responsibility for the stock he or she holds. Stock is closely related to share of the stock. Shares of stock are the content of the stock, and a stock is the manifestation of shares of stock. (2) "Capital fund"

refers to a financial organization stablished by the investors according to the fixed earning targets based on their conditions. It usually invests in stocks and securities in order to get high profits. (3) "Security" refers to negotiable securities issued by the government or enterprises to receive long-term funds. It also refers to certificates issued to investors, proving a debt relationship when the government, financial organizations, enterprises and other organizations borrow money from the society and promise to pay interest according to interest rates and refund the principal according to the agreement. The nature of security is a certificate of debt that is legally valid. It establishes a debt relationship between the purchaser and the issuer. The issuer owes a debt to the investor.

F301 By the end of last year, the total principal of "choice of F3" was _____*yuan*.

F1: "Total principal" refers to total amount of investment by the end of last year.

F302 By the end of last year, the market value of "choice of F3" was _____*yuan*.

F1: "Market value" refers to the value that can be gained according to the current market price if sold.

F4 Did your family have pension/social security/government subsidy as sources of income last year?

1. Yes 5. No *[Skip to F5]*

F401 The total amount of income from pension/social security/government subsidy was: _____*yuan*;

F5 What was "*** (Family member)'s" total earnings last year (including salary, bonus, subsidy, and interest), excluding pension/social security/welfare/government subsidy? _____*yuan*.

Interviewer Note: (1) Exclude agricultural income. If the respondent engaged in agricultural work only, record "-8". (2) For respondents without any income (such as

students), record "0".

[CAPI]If F5= "CTRL+D", "CTRL+R", continue to F501, otherwise interview the next person.

F501 What was the approximate amount of "***Family member's" earnings last year (including salary, bonus, subsidy, and interest), excluding pension/social security/ welfare/government subsidy? (Approximate)

(2500/5000/7500/12000/18000/27000/40000)/

60000/90000/140000/210000/320000/480000 *yuan*

F502 What was the accurate amount of "***Family member's" total earnings last year (including bonus, subsidy, and interest), excluding pension/social security/ welfare/government subsidy? _____*yuan*

[CAPI] If all the family members have F5 = "-8", skip to F7, otherwise, continue to F6.

F6 Last year, what was the approximate amount of your family's total income (including salary, bonus, subsidy, and interest), excluding pension/social security/ welfare/government subsidy? (Approximate) _____

(2500/5000/7500/12000/18000/27000/40000)

/60000/90000/140000/210000/320000/480000 *yuan*

[CAPI] If F6 is in a closed interval, continue to F601 within the range of the interval.

F601 Last year, what was the accurate amount of your family's total income (including salary, bonus, subsidy, and interest), excluding pension/social security/ welfare/ government subsidy? _____*yuan*

F7 Besides the sources of income mentioned above, did your family have any other non-wage or agricultural production income last year?

Interviewer Note: "Sources of income mentioned above" include rental income, demolition compensation, salary, and pension and so on.

The "agricultural production income" here refers to the net income from agricultural production.

1. Yes 5. No *[Skip to F8]*

F701 Last year, what was the amount of the non-wage and agricultural production income? _____ *yuan*

Interviewer Note: It refers to the net income from agricultural production.

F8 What was the approximate amount in cash equivalent to all the monetary /material gifts your family received last year? ____*yuan*

F1: "Approximate amount in cash equivalent" refers to the amount of money needed to buy the gifts.

Part H:

H1 Among all the goods purchased (such as furniture, electronic appliances, toys, etc.) last year, the most expensive one cost _____*yuan.*

Interviewer Note: Neither car nor house is included.

H2 Has your family borrowed money or taken a loan in any of the following ways last year? *[Select all that apply]*

1. Bank (Including credit union) 3. Relatives/Friends 5. Private loan

77. Other *[please specify]* _____ 78. None of these *[Skip to H3]* _____

F1: "Private loan" refers to loans between individuals, between individuals and enterprises, and between enterprises. It does not involve any legal financial organizations. The question here concerns loans from non-financial organizations.

H201 Last year, the loan from "choice of H2" of your family was for _____*yuan*

H202 Last year, the loan was used for

1. Building/buying a house 2. Education 3. Buying durable goods

4. Medical care for family members 5. Family's daily expenditures

77. Other *[please specify]* _____

F1: "Durable goods" refer to products with a unit price above 1000 yuan and a natural service life of 2 years or more.

H203 Last year, the amount of the loan used on "choice of H202" was for _____ *yuan*

Interviewer Note: The amount of loan used to buy the item.

H6 The total expenditure of your family last year was [Approximate]: _____

(2500/5000/7500/12000/18000/27000/40000/

60000/90000/140000/210000/320000/480000 *yuan*）

F1: "Total expenditure" refers to the total amount spent by the family and its members for all the items above, including clothing, food, housing, transportation, marriage, funeral, entertainment, education, health, insurance, loan to others, home mortgage, and all living costs. Business costs are not included.

H601 How much was the total expenditure of your family last year? _____*yuan*

Adult Questionnaire (selected questions)

Part A:

A1 Your date of birth is _____ year _____ month_____ day

A101 Y our birth weight: _____ *[Record to one decimal place]*

A102 Where were you born? _____ Province_____ City_____ County (District)

A2 What is your current household registration status?

Interviewer Note: if the respondent's nationality is not China, record "79 Not applicable".

1. Agricultural 3. Non-agricultural

5. Not registered *[Skip to A3]* 79. Not applicable *[Skip to A3]*

F1: (1) "Not registered" means the child has not registered yet and his/her nationality is not foreign. (2) "Not applicable" means non-Chinese nationality. The parents are Chinese citizens, but the child was born in a foreign country and entitled to foreign citizenship.

A201 What is the place of your current household registration?

_____ Province_____ City_____ County/District

Part C:

C1 What is the highest level of education you have obtained so far?

1. Illiterate/Semi-literate *[Skip to D1]* 2. Primary school 3. Middle school

4. High school 5. 2- or 3-year college 6. 4-year college/Bachelor's degree

7. Master's degree 8. Doctoral degree 9. No need to go to school *[Masked]*

F1: "Highest level of education" is the highest level of education received at school.

Part E:

E1 Your marital status is: *[Show card]*

1. Never married 2. Married 3. Cohabitation 4. Divorced 5. Widowed

F1: (1) "Never married" refers to individuals who have never been married and are not currently cohabitating. (2) "Married" refers to currently having a spouse, including both couples who have marriage certificates and those who live together as married couples without marriage certificates, which are known as factual marriages. (3) "Cohabitation" refers to living with a partner without having a marriage certificate and in a different way from factual marriage. Cohabitation includes living together both before the first marriage and after the first marriage is dissolved. (4) "Divorced" refers to formerly married individuals who are no longer married and have not yet remarried. (5) "Widowed" refers to the situation in which one spouse has passed away, and the other has not remarried.

Part G:

G2 Have you ever had any formal work experience for more than six successive months?

Interviewer Note: Include agricultural work and self-employment.

1. Yes 5. No

G3 Do you currently have a job?

Interviewer Note: Include agricultural work and self-employment.

1. Yes 5. No

中国家庭动态跟踪调查（2010）

(Chinese Translation)

村/居问卷(摘列)

A 部分

A0 请访员记录现在所在的是居委会还是村委会？

1. 居委会　　5. 村委会

Z 部分

访员注意：以下题目通过自己的观察完成，无需向受访者提问。

Z1 村/居经济状况看起来：　　很穷--1--2--3--4--5--6--7--〉很富

Z2 村/居马路的整洁程度：　　很乱--1--2--3--4--5--6--7--〉很整洁

Z3 村/居成员的精神面貌：　　萎靡--1--2--3--4--5--6--7--〉很精神

F1：“萎靡”指精神不振，意志消沉；即通常所说的“没精打采”。

Z4 村/居成员的同质性：　　混杂--1--2--3--4--5--6--7--〉很相似

F1：“同质性”指村/居成员的社会经济状态差别不大。

Z5 村/居的建筑格局：　　很乱--1--2--3--4--5--6--7--〉很整洁

Z6 村/居的房屋拥挤程度：　　拥挤--1--2--3--4--5--6--7--〉宽松

Z7 被访村/居的类型：

访员注意：注意区分城镇和郊区。

1.城市【跳至 Z701】　2.城镇【跳至 Z702】　3.农村【跳至 Z703】　4.郊区【跳至 Z901】

F1：（1）“城市”通常指建制市的人口稠密区，如县级市的市区，地级市的市区。

（2）“城镇”通常指建制县的县政府所在地、乡镇政府所在地。

（3）“农村”通常指以村庄形态出现、主要从事农业生产的人口聚居区。

（4）“郊区”通常指建制市的人口稠密区边缘、行政上属于建制市的人口聚居区。

家庭问卷（摘列）

1.同住家庭成员表（T1 表）

个人编码								
101								
102								

301								
302								

F1：（1）编码为 1**的成员为与家庭有血缘/婚姻/领养关系的成员，包括岳父母/继父母/外甥孙/侄子孙等，也是需要进入表 T2 的成员，并可能有个人问卷的成员。

（2）编码为 3**的成员为与家庭没血缘/婚姻/领养关系的成员，如保姆、司机、勤杂人员、临时借住人员等，这些人是不进入表 T2，也不会有个人问卷的成员。

确认家庭人口确认回答人：

A1 您是否与这个家庭的其他人同灶吃饭？

1. 是【跳至 A2】　　5. 否【继续提问】

F1：“同灶吃饭”指经济联系在一起的家庭和非家庭成员，包括了有直系血缘/亲缘关系的成员以及在家里工作的非直系血缘/亲缘关系的成员如保姆、司机、担任保姆工作的远房亲戚等。

A101 您家是否属于单身家庭？

1. 是【跳至 A201】　　5. 否【选择另一名家庭成员作为受访对象】

F1：“单身家庭”指一个人就是一家的家庭。

【CAPI】如果 A101 选择“5”，返回重新提问 A1。

A2 您与这个家庭的其他人是否有血缘/婚姻/领养关系？

1. 是【继续提问】　　5. 否【选择另一名家庭成员作为受访对象】

【CAPI】如果 A2 选择“5”，返回重新提问 A1。

A201 您的姓名是：_____

【CAPI】如果 A101 选择“1”，跳至 B1。

A3 请问，现在，在您家，除了您以外，同灶吃饭的共有几口人？　　___人

访员注意：以下 7 类人如果与家里有经济联系，他们的人数应该包含在同灶吃饭的人数里。请跟

受访者确认本题所回答的人数是否已经包含以下 7 类人。

1. 外出读书　　2. 外出打工/工作　　3. 出家　　4. 探亲访友

5. 服刑　　6. 参军/服役　　7. 出境（包含港、澳、台）

F1：“同灶吃饭”指经济联系在一起的家庭和非家庭成员，包括了有直系血缘/亲缘关系的成员以及在家里工作的非直系血缘/亲缘关系的成员如保姆、司机、担任保姆工作的远房亲戚等。

A4 除了您本人以外，在您家同灶吃饭的人中，有几口人是与您或您家人有血缘/婚姻/领养关系的**直系**家属/亲属？　　_____人

访员注意 ：这道题目根据实际情况进行判断，无需向受访者提问。

F1：“直系”血缘/亲缘关系成员包括（1）在外上学的学生；（2）当兵的子女；（3）经济上与家庭没有分开的、在外打工的成员。

A401 这些在您家同灶吃饭的，与您或您家人有血缘/婚姻/领养关系的**直系家属/亲属**，他们分别叫什么名字？_____,_____,_____

A5 在您家同灶吃饭的人中，有几口人是与您或您家人有血缘/婚姻/领养关系的**非直系家属/亲属**？_____人

访员注意 ：这道题目根据实际情况进行判断，无需向受访者提问。

F1：“非直系家属/亲属”指岳父母/岳祖父母/外甥孙/侄孙/表亲等，领养子女属于直系。

A501 在与您或与您家人有血缘/婚姻/领养关系的**非直系家属/亲属**“加载 A5 的数值”人中，到目前为止，在这个家中居住时间在 3 个月或以上的有几人？　_____人

F1：“非直系家属/亲属”，指岳父母/岳祖父母/外甥孙/侄孙/表亲等，领养子女属于直系。

A502 这些在您家同灶吃饭的，居住 3 个月或以上的**非直系**的家属/亲属成员，他们分别叫什么名字？

_____,_____,_____

A6 在您家同灶吃饭的人中，有几口人与您或家人没有血缘/婚姻/领养关系？　_____人

访员注意 ：这道题目根据实际情况进行判断，无需向受访者提问。

A601 在与您或与您家人没有血缘/婚姻/领养关系的“加载 A6 的数值”人中，到目前为止，在这个家中居住时间在 6 个月或以上的有几人？　　_____人

A602 这些与您或家人没有血缘/婚姻/领养关系分别叫什么名字？

_____,_____,_____

B1 “加载家庭成员姓名”的出生日期？　_____年____月____日；属相____；年龄_____。

访员注意：（1）输入格式：四位年份，两位月份，两位日期。

（2）如不清楚月份，或不清楚日期，请输入“CTRL+D”。

（3）如果仅知道年龄不知道出生年月，请输入“CTRL+D”，输入属相和年龄。

B2“加载家庭成员姓名”的性别？

1. 男　　5. 女

B3“加载家庭成员姓名”的婚姻状况？【婚姻状况选项简表】【出示卡片】

1. 未婚　　2. 在婚　　3. 同居　　4. 离婚　　5. 丧偶

B4 “加载家庭成员姓名”已经完成的最高学历？【受教育程度选项简表】

访员注意：如果还未读完小学，请选择“1. 文盲/半文盲”。

1. 文盲/半文盲　　2. 小学　　3. 初中　　4. 高中

5. 大专　　6. 大学本科　　7. 硕士　　8. 博士

B5“加载家庭成员姓名”的主要工作是？　　_____

访员注意：（1）如果受访者有多份工作，请询问占用时间最多的工作。

（2）如果受访者没有工作，则录入“-8 不适用”。

（3）请详细记录受访者的主要工作，填写具体内容；工作部门＋工作职责/工作内容＋工作岗位或工种名称。

例如：××小学教语文兼年级组长；××公司会计；××工厂××车间主任；××县××医院护士；本村种植水稻的农民

B501“加载家庭成员姓名”是否有行政/管理职务？

1. 是　　5. 否【跳至 B6】

B502“加载家庭成员姓名”的行政/管理职务是什么？_____

访员注意：请详细记录受访者的管理职务。

B6 “加载家庭成员姓名”现在是否住在这个家中？

访员注意：短期离开不算离开。“短期离开”指三个月内会回来，并且会在这个家里长住。

1. 是【跳至下一名家庭成员】　　5. 否【继续提问】

B601 “加载家庭成员姓名”为什么不住在这个家中？

访员注意：去国外读书选 7。

1. 外出读书　　2. 外出打工/工作　　3. 出家　　4. 探亲访友

5. 服刑　　6. 参军/服役　　7. 出境（包含港、澳、台）

2.家庭成员直系亲属关系表（T2 表）

个人编码	姓名	父亲	母亲	配偶	孩 1	孩 2	孩 3	孩 4	孩 5	孩 6

101										
102										

C1 “加载家庭成员姓名”的父亲是？_____

C2 “加载家庭成员姓名”的母亲是？_____

C3 “加载家庭成员姓名”的配偶是？_____

C4 “加载家庭成员姓名”的孩子是？_____

3.家庭成员不同住直系亲属列表（T3 表）

个人编码										
201										
202										

D1“加载不同住直系亲属姓名”的出生日期？____年____月____日；属相____；年龄_____。

访员注意：（1）输入格式：四位年份—两位月份—两位日期。

（2）如不清楚月份，或不清楚日期，请输入“CTRL+D”。

（3）如果仅知道年龄不知道出生年月，请输入“CTRL+D”，输入属相和年龄。

D2 “加载不同住直系亲属姓名”的性别？

1. 男　　5. 女

D3 “加载不同住直系亲属姓名”是否健在？

1. 是【继续提问】　　5. 否【跳至下一名“不同住直系亲属”】

D4 “加载不同住直系亲属姓名”的婚姻状况？【婚姻状况选项简表】【出示卡片】

1. 未婚　　2. 在婚　　3. 同居　　4. 离婚　　5. 丧偶

D5 “加载不同住直系亲属姓名”已经完成的最高学历？【受教育程度选项简表】

访员注意：如果还未读完小学，请选择“1. 文盲/半文盲”。

1. 文盲/半文盲　　2. 小学　　3. 初中　　4. 高中

5. 大专　　6. 大学本科　　7. 硕士　　8. 博士

【CAPI】如果受访者年龄小于 16 岁则跳至 D7。

D6 “加载不同住直系亲属姓名”的主要工作是？　　_____

访员注意：（1）如果受访者有多份工作，请询问占用时间最多的工作；

（2）如果受访者没有工作，则录入“-8 不适用”。

（3）请详细记录受访者的主要工作，填写具体内容；工作部门＋工作职责/工作内容＋工作岗位或工种名称。

例如：××小学教语文兼年级组长；××公司会计；××工厂××车间主任；××县××医院护士；本村种植水稻的农民

【CAPI】如果 D6 答案为“-8”，跳至 D7。

D601 “加载不同住直系亲属姓名”的是否有行政/管理职务？

1.是　　5.否【跳至 D7】

D602 “加载不同住直系亲属姓名”的行政/管理职务是什么？ ____

访员注意：请详细记录受访者的管理职务。

D7 “加载不同住直系亲属姓名”现在居住在哪里？【居住地点选项】

1.隔壁/邻居　2.同村/同街　3.同县/区但不同村/街　4.同市但不同县

5.同省但不同市　6.外省_____省　7.境外（包含港、澳、台）

D8 “加载不同住直系亲属姓名”的户口是？

访员注意：如果受访者不是中国国籍，属于不适用，请录入“79”。

1. 农业户口　3. 非农业户口　5. 没有户口　79. 不适用

家庭问卷（摘列）

D 部分

D1 您家现在居住的房子是【**出示卡片**，单选】：

1. 完全自有【跳至 D101】　2. 和单位共有产权【跳至 D110】　3. 租住【跳至 D120】　4. 政府免费提供【跳至 D2】　5. 单位免费提供【跳至 D2】

6. 父母/子女提供【跳至 D2】　7. 其他亲友借住【跳至 D2】

77. 其他【请注明】_____【跳至 D2】

F1：（1）“完全自有”指受访家庭有“房产证、土地证、契税完税证明”三证；对农村受访家庭而言，自己修建的房子，就属于这类。

（2）“和单位共有产权”是指居民出钱购买部分产权，产权单位购买余下部分，如果住户手里没有土地证，就是与单位共有产权，大多数原来属于单位的住房在房改中，都采用了单位持有土地证的形式，即“共有”。

E 部分

E1 过去一年，您家是否有人外出工作？

1. 有　3. 无【跳至 E2】　5. 去年尚未成家【跳至 E2】

F1：（1）“外出”指不在自己户口和/或家庭常住地工作，农村通常指县/县级市以外，城市通常指本市以外。

（2）“外出工作”指非永久性离开家庭所在县（市）的就业，如农村人口外出打工。

【CAPI】如果 E1 选择“1”则进入【外出工作模块】，否则跳至 E2。

E2 您家是以下哪种政府确定的补助对象【可多选】

1. 低保户【跳至 E201】　2. 军属【跳至 E202】　3. 烈属【跳至 E202】

4. 残疾人员家属【跳至 E202】　78. 以上都不是【跳至 E3】

E201 您认为最主要的致贫原因是：

访员注意：如果有多个原因，请选择最主要的。

1. 缺少劳动力　2. 自然条件差或灾害　3. 因疾病或损伤原因　4. 下岗、失业

5. 投资失败　77. 其他原因【请注明】_____

E202 去年全年，您家从各级政府一共得到多少补助（含**实物**和现金）？　_____元。

E3 您家是否参与经营或完全经营非农产业？

1. 是　5. 否【跳至 E4】

【CAPI】如果 E3 选择“1”则进入【非农经营模块】，否则跳至 E4。

E4 您家去年是否出租过房屋？

1. 是　　5. 否【跳至 E5】

F1：“出租房租”是把房屋租给他人使用，并收取租金。

E401 去年全年，您家出租房屋的租金**总**收入为 _____元

访员注意：此处填写去年全年的实际的出租收入。如果该房屋去年只出租了 3 个月，则此处填写 3 个月的总金额。

E5 ″是否出租过土地等″:去年，您家是否出租过土地或其他生产资料？

1. 是【提问 E501】　　5. 否【跳至 E6】

F1：“生产资料”指用于生产和建设的产品，包括工业生产资料和农业生产资料两个大的部分。

E501 去年全年，您家出租土地或其他生产资料的租金**总**收入为 _____元

E6 去年，您家是否出租过其他东西？

1. 是【提问 E601】　　5. 否【跳至 E7】

E601 去年全年出租其他东西的租金**总**收入为 _____元

E7 去年，您家是否出卖过财物（家里的东西）？

访员注意：不含农产品。

1. 是【提问 E701】　　5. 否【跳至 E8】

E701 去年全年，您家出卖财物的**总**收入为 _____元

E8 您家是否经历过拆迁？

1. 是【继续提问 E801】　　5. 否【跳至 E9】

F1：“拆迁”是指根据城镇规划进行开发建设的单位，经过规定的管理机关批准，拆除公民、法人或者其他组织所有的房屋，并按照公开市场价值对该公民、法人或者其他组织进行补偿、安置的行为。

E801 您家是哪年拆迁的？　　_____年

E802 您家获得拆迁补偿金总额为 _____元

E9 您家是否经历过土地被征用？

1. 是【继续提问 E901】　　5. 否【跳至 F1】

F1：“土地征用”是指政府为社会公共利益的需要，按照法律规定的批准权限和程序，并给农民集体和个人补偿后，将农民集体所有的土地转变为国家所有。土地征用是保证国家公共设施和公益事业建设所需土地的一项重要措施。

E901 您家的土地是哪年被征用的？ _____年

E902 您家有多大面积的土地被征用？ _____亩

E903 您家获得的征地补偿金总额为 _____元

F 部分

F1 去年，您家是否存过钱？

访员注意 ：无论年底是否有存款，是要有过存款行为就算“存过钱”。

1. 是　　5. 否

F2 去年底，您家各种存款余额总计为_____元

访员注意 ：如果没有存款，请录入“0”。

F1（通俗）：“存款”指存在银行或支付利息的机构/个人的钱。

F1（专业）：“存款”是指银行或其他信用机构吸纳社会闲散货币资金并根据存款的性质、种类、期限计付给存户一定的利息的信用活动。这里是指存款余额为正，在计算利息过程中，不分不同种类的存款形式。问的是存款所获得的利息总额。

【CAPI】如果 F2 回答为“0”，则提问 F3；否则提问 F201。

F201 去年底，您家各种存款的利息总计为 _____元

F1（通俗）：“存款”指存在银行或支付利息的机构/个人的钱。

F1（专业）：“存款”是指银行或其他信用机构吸纳社会闲散货币资金并根据存款的性质、种类、期限计付给存户一定的利息的信用活动。这里是指存款余额为正，在计算利息过程中，不分不同种类的存款形式。问的是存款所获得的利息总额。

F3 去年，您家是否持有以下金融产品？【可多选】

1.股票　　3.基金　　5.债券　　78.以上均没有【跳至 F4】

F1（通俗）：“股票、基金、债券”指在国内外证券市场上购买的有价证券。

F1（专业）：（1）“股票”是指股份有限公司签发的、证明其股东按所持股份享受权益并承担义务的凭证，股票与股份有密切的联系，股份是股票的内容股票是股份的表现形式。

（2）“基金”是指投资者根据自身状况确定投资收益目标自发自愿形成的非银行性金融组织，主要投务于股票、债券以便获取高额回报。

（3）“债券”是指国家或企业为取得长期资金而发行的有价证券；也是政府、金融机构、工商企业等机构直接向社会借债筹措资金时，向投资者发行、承诺按一定利率支付利息并按约定偿还本金的债权债务凭证。债券的本质是债的证明书，具有法律效力。债券购买者与发行者之间是一种债券债务关系，债券发行人即债务人，

投资者（或债券持有人）即债权人。

F301 去年底，“F3 的选项”本金总额为_____元

F1：“本金”指截止去年底，一共投入多少钱。

F302 去年底，“F3 的选项”市值为 _____元

F1：“市值”是指按照当前价格出售所能获得的价值。

F4 去年，您家是否有离/退休金/社会保障金/低保等收入来源？

1. 是　　5. 否【跳至 F5】

F401 去年全年，您家离/退休金/社会保障金/低保等收入一共有多少？____元

F5 ***去年的（含工资、奖金、补贴、分到个人名下的红利等）收入是多少，不含离/退休金及其他政府补助？_____元

访员注意：（1）不包含农业收入，若是只从事农业生产活动的农民，则录入“-8”。

（2）没有收入的人群（如学生），录入 0。

【CAPI】如果 F5 答案为“CTRL+D”，“CTRL+R”则提问 F501，否则询问下一个人。

F501***去年的（含工资、奖金、补贴、分到个人名下的红利等）收入，不含离/退休金及其他政府补助，大约是多少？（逼近法）

（2500/5000/7500/12000/18000/27000/40000 元）

/60000/90000/140000/210000/320000/480000

F502***去年的（含工资、奖金、补贴、分到个人名下的红利等）总收入，不含离/退休金及其他政府补助，具体为多少？_____元

【CAPI】如果所有家庭成员 F5 的答案都为“-8”，则跳至 F7；否则提问 F6。

F6 去年全年，您家的（含工资、奖金、补贴、分到个人名下的红利等）总收入，不含离/退休金及其他政府补助，大约是多少？（逼近法）

（2500/5000/7500/12000/18000/27000/40000 元）

/60000/90000/140000/210000/320000/480000

【CAPI】F6 进入一个封闭区间后，继续以确定区间的范围为 range 提问 F601。

F601 去年，您家的（含工资、奖金、补贴、分到个人名下的红利等）总收入，不含离/退休金及其他政府补助，具体为多少？_____元

F7 去年，除了以上提到的收入来源外，您家还有其他非工资性或**农业生产收入**吗？

访员注意：“以上提到的收入来源”包括租金、拆迁款、工资及退休金等。此处“农业产收入”指农业生产的净收入。

1. 是　　5. 否【跳至 F8】

F701 去年，您家其他非工资性收入或农业收入一共有多少？ _____元

访员注意 ：此处“农业收入”指净收入。

F8 去年，您家收到的礼金/礼品，折合为现金共计_____元

F1：“折合为现金”指如果购买所收到的礼物需要花的钱数。

H 部分

H1 去年，您家购买的家庭消费品（如家具、电器、玩具等）中，最贵的一件花了多少钱？

_____元。

访员注意 ：汽车、房屋除外。

H2 去年，您家是否通过以下途径借款或贷款？【可多选】

1. 银行（包括信用社）　　3. 亲戚/朋友　　5. 民间借贷

77. 其他方式【请注明】_____ 78. 以上均没有【跳至 H3】

F1：“民间借贷”是指游离于经国家依法批准设立的金融机构之外的所有以货币形式、有利息回报的个人与个人、个人与企业、企业与企业之间的资金筹借活动。本题指向非金融机构借贷。

H201 去年全年，您家通过“加载 H2 选项”借款或贷款的总额为：_____元

H202 去年，您家所有借款或贷款主要用于以下哪几方面？

1. 用于建房、购房　　2. 用于教育　　3.用于购买耐用消费品

4. 用于家庭成员治病　　5.用于家庭日常生活开支　　77.用于其他方面【请注明】_____

F1：“耐用消费品”是指单位价格在 1000 元以上、自然使用寿命在 2 年以上的产品。

H203 去年全年，您家用于“加载 H202 选项”的借款或贷款额有多少？___元

访员注意 ：仅为该项开支中用借款或贷款支付的金额。

H6 去年，您家的总支出【逼近法】

（2500/5000/7500/12000/18000/27000/40000

/60000/90000/140000/210000/320000/480000 元）

F1：“总支出”指家庭及所有成员各项支出的合计，包括衣、食、住、行、婚、丧、嫁、娶、玩、乐、教育、健康、购买保险、借钱给人、按揭等各项生活性支出，不包括任何经营性支出。

H601 去年，您家总支出大概是多少钱？_____元

成人问卷（摘列）

A 部分

A1 请问您的出生日期：_____年_____月_____日

A101 请问您出生时的体重是：_____斤【保留 1 位小数点】

A102 请问您的出生地是？_____省_____市_____县（区）

A2 您现在的户口状况是：

访员注意：如果受访者是非中国国籍，属于不适用，请录入“79”。

1. 农业户口　　3. 非农户口　5. 没有户口【跳至 A3】　79. 不适用【跳至 A3】

F1：（1）“没有户口”指在中国没有落户，也没有其他国籍。

（2）“不适用”指非中国国籍受访者，如父母为中国公民，但孩子在国外出生并拥有外国国籍。

A201 您现在的户口落在什么地方：_____省_____市_____县（区）

C 部分

C1 请问，到目前为止，您已完成（毕业）的最高学历是？【受教育程度选项】

1. 文盲/半文盲【跳至 D1】　2. 小学　3. 初中　4. 高中

5. 大专　6. 大学本科　7. 硕士　8. 博士　9. 不必念书【屏蔽】

F1：最高学历，指接受学校教育的最高程度。

E 部分

E1 请问您现在的婚姻状态是？【出示卡片】【婚姻选项】

1. 未婚　2. 在婚　3. 同居　4. 离婚　5. 丧偶

F1：（1）“未婚”指从来没有结过婚，目前也没有同居。

（2）“在婚”指目前有配偶，包括有结婚证的配偶，也包括没有结婚证但事实上以配偶方式生活在一起的配偶，即事实婚姻的配偶。

（3）“同居”指男女双方居住在一起，但没有领取结婚证，也没有事实婚姻；这里既指没有初婚的同居，也指有过初婚的同居。

（4）“离婚”指曾经结过婚，离婚后没有再婚，目前处于没有配偶状态。

（5）“丧偶”指配偶一方已经去世，另一方没有再婚。

G 部分

G2 您是否**有过**正式的、连续超过 6 个月的工作经历？

访员注意：工作含务农、自雇。

1. 有过　5. 没有

G3 您现在有工作吗？

访员注意：工作含务农、自雇。

1. 有　　5. 没有