

The Economic implication of retirement age extension in China

--A Dynamic general equilibrium analysis

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1 Introduction

China has experienced remarkable growth in the past three decades, while her growing labour force has played an important role in this extraordinary growth phase (World Bank, 2012). However the situation will change. The growth of the working age population will stop at around 2015 and turn strongly negative afterwards. Meanwhile the proportion of the old population aged 65 and over will increase dramatically, from 8.2 per cent in 2010 to an estimated 25.6 per cent in 2050 (United Nations, 2010). As a result, the support ratio which is defined as the ratio of working age population to the elderly population will drop significantly from 8.8:1 in 2010 to 2.4:1 in 2050. This poses a great threat to China's pension system and sustainability of economic growth. Furthermore, China's low retirement age compounds the ageing problem. Currently the retirement age is 60 for male employees, 55 for female officials and 50 for female workers. Based on the current retirement ages, the support ratio will be even lower. To mitigate the negative effects of the shrinking support ratio on economic growth, it is essential that labour force participation among the current working age population is adequate (World Bank, 2012). Raising the official retirement age is one of the strategies to encourage labour force participation. Using the tools of dynamic CGE modelling, this paper will estimate the effect of retirement age extension on the supply of the labour, and therefore on China's economic growth over the period of 2010 to 2030.

This paper is organised as follows. The second section investigates the effect of population ageing on labour force participation rates, and therefore on labour supply over the period of 2010 to 2030. The third section estimates the effect of retirement age extension scheme on the supply of the labour force. The modelling framework is displayed in section four. The section five discusses the effects of retirement age extension on China's economic growth and the last section is the conclusion and policy implications.

2. Population projection and China's labour supply

The rapid population ageing and potential labour supply contraction at around 2015 are primarily the result of the dramatic decline in fertility rates during the 1970s and 80s and the low fertility in the 1990s. The population evolvement in the future will depend on the changes in the fertility rate and mortality rate. In this paper I adopt Mai, Peng and Chen's population projection result with medium fertility rate and medium pace of mortality

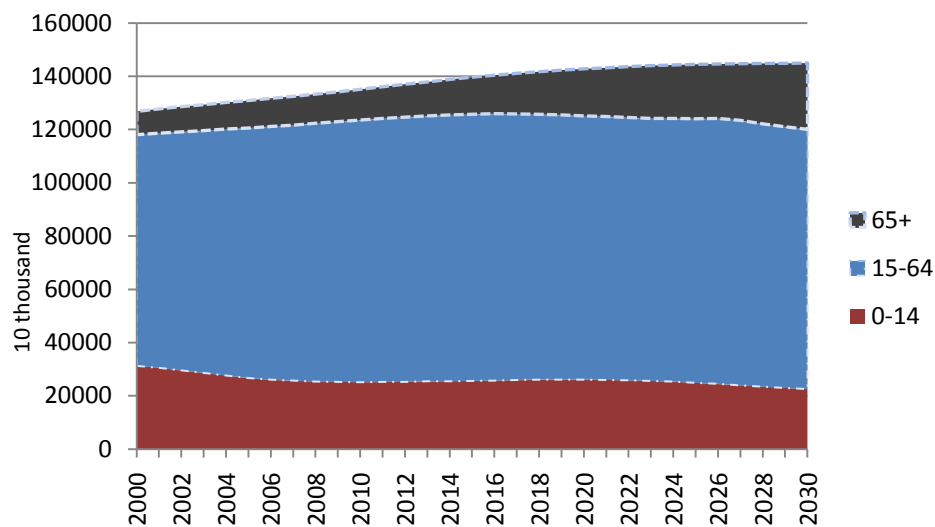
improvement assumption (Medium-MP) (Mai, Peng and Chen, 2013) to explore the effects of population ageing on labour force participation rates, therefore on labour supply. The detailed assumption of the fertility rate is that China's total fertility rate will increase linearly from 1.67 in 2005 to 1.8 in 2015 and then it will stay at 1.8 till 2030. The reason for use Mai, Peng and Chen's Medium variant population projection result is that their fertility assumptions are more close to China's future fertility rates. A TFR of 1.8 children per woman represents the government-targeted fertility level in the long run when the current fertility policy would be gradually changed to a two-child policy (The Project Group on National Population Development Strategies, 2007). In fact, China's central fertility policy has been increasingly localised and diversified at provincial and lower levels (Guo, Zhang, Gu, & Wang, 2003). Currently there is a two-child policy applied to couples where both partners are the only child, and in rare cases, to couples where either partner is an only child. Birth spacing policies have also been relaxed or abolished in many provinces and restrictions on timing of marriage and births have largely been removed from existing policies. The medium fertility assumption is often considered to be the most likely future scenario (Mai, Peng and Chen, 2013). Future assumptions about changes in life expectancy at birth at Mai, Peng and Chen's population projection are made following the United Nations models (four different paces) for mortality improvement (United Nations, 2006). In this paper we adopt the scenario of medium pace of mortality improvement.

2.1 China's population from 2010 to 2030

Figure 1 displays the population projection for China over the period of 2000 to 2030. Even though China's fertility rate is below replacement level, China's population will continue growing for many years. Total population will increase from 1.27 billion in 2000 to 1.45 billion in 2030. The working age population aged 15 to 65 will reach its peak at 1.0 billion in 2016 and then begin to decline. There will be 974 million working age population in 2030. The older population aged 65+ will keep increase. There was 87.1 million for this age group at the beginning of the 21st century and it will reach 249.7 million in 2030, which is nearly tripled the size of year 2000. Figure two shows that the proportion of older population aged 65 and above will increase from less than 7 per cent in 2000 to more than 17 per cent in 2030. The rapid increase of older population combining with the declining working age population

will increase China's old dependency ratio¹ (ODR) dramatically. Figure 3 shows that ODR will increase rapidly from 0.1 in 2000 to 0.256 in 2030 and it will surpass the YDR in 2029. This means that supporting the elderly population will become a major burden for the working age population from the 2030. Though the declining YDR will slow the increase of TDR it cannot reverse its rising trend. TDR will reach 0.49 in 2030 which means that every working age population will support nearly half of dependent population.

Figure 1: Evolution of China's population



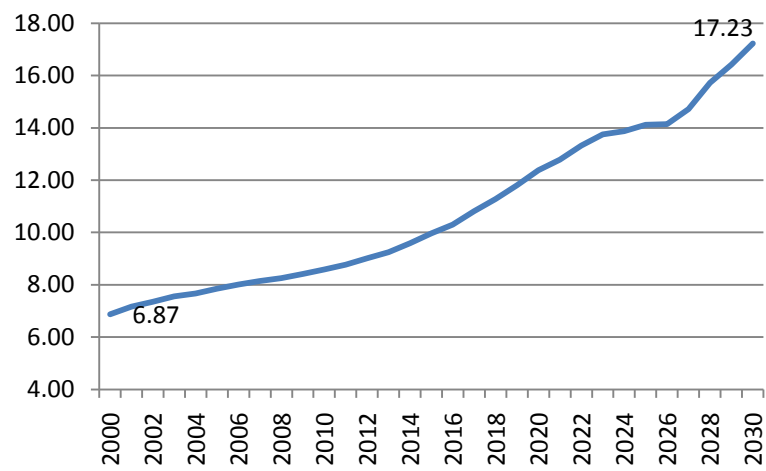
Source: Mai, Peng and Chen (2013)

2.2 Population ageing, labour force participation rate and labour supply

Since not every working age person is active in the labour market, the labour supply of a country is the product of the size of the working age population in each age and gender category and the age-and gender-specific labour force participation rates (McDonald and Kippen 2001). Since changing age structures such as population ageing affect the age-specific labour force participation rates, it changes the aggregate labour force participation rate (ALFPR) (Dugan and Robidoux, 1999) and therefore it affects total supply of labour. We use a simple accounting framework to calculate the trend of the ALFPR from 2010 to 2030 in China.

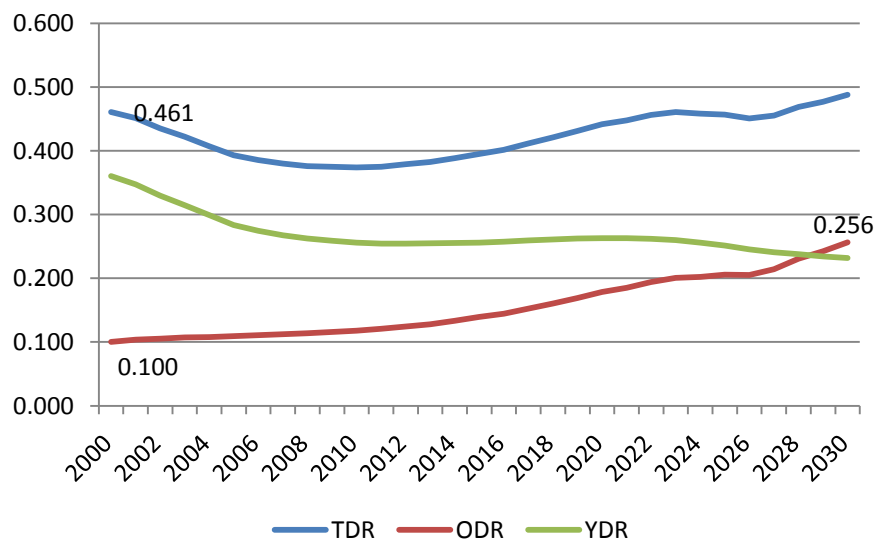
¹ Old dependency ratio (ODR) is defined as the ratio of the population aged 65 and above over to the working age population aged 15 to 64. Youth dependency ratio (YDR) is defined as the ratio of the population aged 0 -14 over to the working age population aged 15 to 64, and the total dependency ratio (TDR) is the sum of old dependency ratio and youth dependency ratio.

Figure 2: Proportion of population aged 65+



Source: Mai, Peng and Chen (2013)

Figure 3: Evolution of China's dependency ratio



Source: Mai, Peng and Chen (2013)

$$ALFPR_t = \sum_{i=1}^j s_{i,t} PR_{i,t} \quad (1)$$

$$s_{i,t} = WP_{i,t} / WP_t \quad (2)$$

Where $ALFPR_t$ is the ALFPR in year t , $PR_{i,t}$ is the participation rate of cohort i in year t , and $s_{i,t}$ is the share of cohort i in the total working age population aged 15 to 64, WP_t , in year t . We identify ten 5-year gender-specific cohorts ($i=1, 2, \dots, 10$) in the analysis. Equation (1) shows that changes in the ALFPR reflect either changes in cohort (age-specific) participation rates or changes in the composition of the working age population for given cohort participation rates - the demographic composition effect.

Many social, economic and cultural factors influence the cohort participation rates. In this section we will ignore such changes and only calculate the demographic composition effect.

The data from China's fifth population census in 2010 show that the ALFPR was 76.73 per cent. Detailed cohort and gender specific participation rates in 2010 are shown in Table 1 (second column). We estimate the trend of the ALFPR during 2010 to 2030 by assuming that the cohort participation rates remain at their 2010 level. It is convenient to define this effect with the following equation:

$$ALFPR_t = \sum_{i=1}^j s_{i,t} PR_{t,10} \quad (3)$$

$ALFPR_t$ is the aggregate participation rate that would have been observed at time t if all cohort participation rates remain at their 2010 levels. Table 1 presents the estimates of aggregate labour force participation rates for the medium fertility scenario. The evolution of the demographic age structure reduces the ALFPR from 76.73 per cent in 2010 to approximately 74.39 per cent in 2030 if China's TFR remains at 1.8. The demographic composition effect from 2010 to 2030 is 2.15 percentage points. As a result, the total labour force will contract to 726.74 million (Table 2 and Figure 4) which means a 14.4 per cent below its level in 2010.

Table 1: Detailed Demographic composition effect on labour force participation rate in China from 2010 to 2030 (selected years)

Age group	2010			2015	
	PR* (Per cent) (1)	Source population weights (Per cent) (2)	Contribution to aggregate participation rate (Per cent) (2)*(1)/100	Source population weights (Per cent) (3)	Contribution to aggregate participation rate (Per cent) (3)*(1)/100
Men 15-19	34.8	5.33	1.85	4.61	1.60
Women 15-19	32	4.79	1.53	4.09	1.31
Men 20-24	76.2	6.58	5.01	5.22	3.98
Women 20-24	69.3	6.03	4.18	4.69	3.25
Men 25-29	95.8	5.39	5.16	6.43	6.16
Women 25-29	82.1	5.03	4.13	5.90	4.85
Men 30-34	97	4.87	4.72	5.26	5.10
Women 30-34	83.2	4.67	3.88	4.92	4.09
Men 35-39	97	6.06	5.87	4.75	4.61
Women 35-39	84.4	5.73	4.84	4.57	3.85
Men 40-44	96.5	6.51	6.28	5.89	5.68
Women 40-44	84.8	6.17	5.24	5.60	4.75
Men 45-49	95.1	5.55	5.28	6.31	6.00
Women 45-49	80.1	5.26	4.21	6.02	4.82
Men 50-54	89.8	4.11	3.69	5.34	4.80
Women 50-54	62.4	3.83	2.39	5.10	3.18
Men 55-59	80.4	4.19	3.37	3.91	3.14
Women 55-59	53.8	4.02	2.16	3.68	1.98
Men 60-64	58.3	3.01	1.75	3.89	2.27
Women 60-64	40.6	2.88	1.17	3.81	1.55
Total	76.73	100	76.73	100	76.98

*PA is participation rate.

Table 1 (continued): Detailed Demographic composition effect on labour force participation rate in China from 2010 to 2050

Age group	2020		2025		2030	
	Source population weights (Per cent) (6)	Contribution to aggregate participation rate (Per cent) (6)*(1)/100	Source population weights (Per cent) (7)	Contribution to aggregate participation rate (Per cent) (7)*(1)/100	Source population weights (Per cent) (8)	Contribution to aggregate participation rate (Per cent) (8)*(1)/100
Men 15-19	4.19	1.46	4.46	1.55	4.87	1.69
Women 15-19	3.73	1.19	4.08	1.30	4.55	1.46
Men 20-24	4.64	3.54	4.18	3.18	4.52	3.45
Women 20-24	4.13	2.86	3.72	2.58	4.14	2.87
Men 25-29	5.24	5.02	4.62	4.42	4.23	4.05
Women 25-29	4.73	3.88	4.11	3.38	3.78	3.10
Men 30-34	6.46	6.27	5.22	5.06	4.68	4.54
Women 30-34	5.94	4.95	4.71	3.92	4.17	3.47
Men 35-39	5.28	5.12	6.42	6.23	5.28	5.12
Women 35-39	4.95	4.18	5.92	5.00	4.77	4.03
Men 40-44	4.75	4.59	5.23	5.05	6.48	6.25
Women 40-44	4.59	3.89	4.92	4.18	6.00	5.08
Men 45-49	5.87	5.58	4.70	4.47	5.27	5.01
Women 45-49	5.61	4.50	4.55	3.65	4.98	3.99
Men 50-54	6.25	5.61	5.76	5.18	4.70	4.22
Women 50-54	6.00	3.74	5.55	3.46	4.58	2.86
Men 55-59	5.23	4.21	6.07	4.88	5.71	4.59
Women 55-59	5.05	2.72	5.89	3.17	5.55	2.99
Men 60-64	3.74	2.18	4.99	2.91	5.92	3.45
Women 60-64	3.59	1.46	4.90	1.99	5.83	2.37
Total	100	76.95	100	75.54	100	74.58

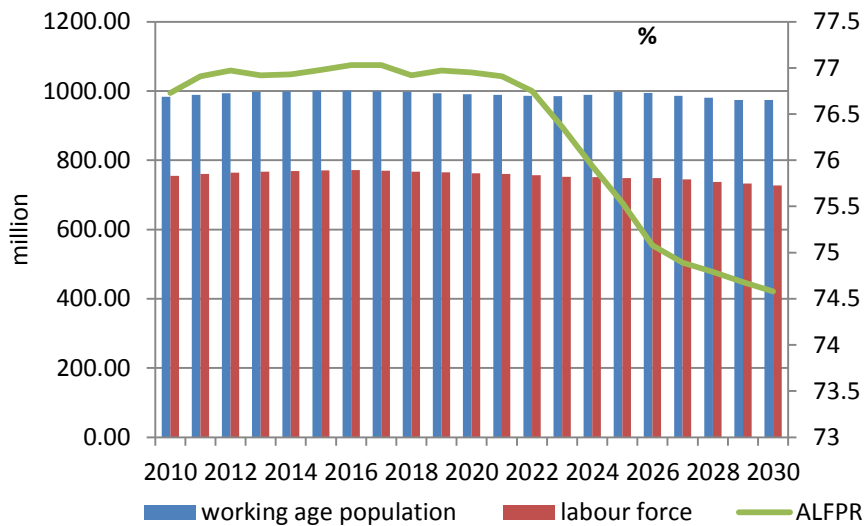
Source: Data in column one is calculated by the authors based on China's fifth population census in 2010 and data in columns two to eight is calculated by the authors based on Mai, Peng and Chen (2013) population projection (medium fertility and medium mortality improvement pace) (2013).

Table 2: Population aged 15 to 64, (selected years)

Year	Working age population (million)	Aggregate labour force participation rate (%)	Labour force (million)
2010	983.43	76.73	754.63
2015	1000.67	76.98	770.34
2020	990.66	76.95	762.32
2025	991.26	75.54	748.85
2030	974.39	74.58	726.74

Source: Mai, Peng and Chen (2013).

Figure 4: Evolution of China's labour force



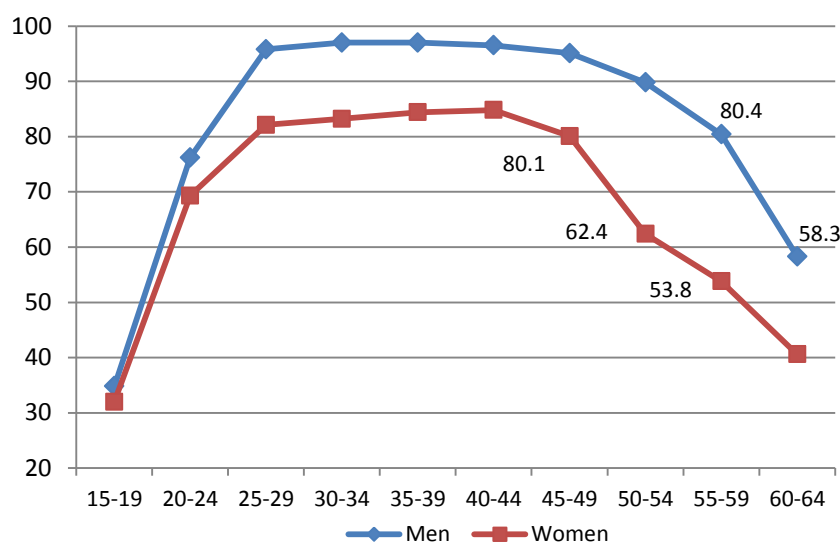
Source: data for working age population from Mai, Peng and Chen (2013). ALFPR and labour force are calculated by the authors based on China's fifth population census in 2010 and Mai, Peng and Chen (2013).

3. Retirement age and labour force participation rate

The labour force participation rate (LFPR) for the population aged 50 and over has a very close relationship with the official retirement age and pension policy. We notice that the LFPR for the female age group 45-49 is 80.1 per cent in 2010 (Figure 5). However it decreases sharply to 62.4 per cent for the female age group 50-54 (nearly 18 percentage points lower). It further declines to 53.8 per cent for the female group 55-59. One main reason is China's retirement policy. In China the retirement age for female workers is 50, for female officers is 55 and 60 for male employees. For male, we notice that it decrease sharply

for the age group 60-64 which is 58.3 per cent in 2010 while it is 80.4 per cent for the age group 55-59.

Figure 5: Labour force participation rate in 2010



Source: National Bureau of Statistics of China, 2012. *China 2010 national population census tabulations*.

Comparing with other countries in the World, China's retirement age is very low. For most of developed countries, their retirement age is 65 for both men and women. With the expected decline of the working age population in China, increase the retirement age will be an effective way to increase labour force participation rate. Furthermore, China's current retirement policy was introduced in the 1970s when the average life expectancy for both men and women was 65. But during the past 40 years, the life span of Chinese citizens has increased to 75 years (NBS, 2012). Gradually increase the retirement age will not only help to slow down the reduction of an effective workforce but also lower the expected raise in labour costs. It will also help to reduce the pressure on the pension fund which has been reported in deficit in many provinces (CRIENGLISH, 2012). In this paper we will estimate the economic implications of retirement age extension in China. We assume that Chinese government will gradually increase workers' retirement age from 2015. For female workers, their retirement age will be gradually increased from current 50 to 55, and for female officials, it will be gradually increased from current 55 to 60. For male employees their retirement age will be gradually increase to 65 from current 60. The increase of retirement age will result in an increase in the LFPR. To our knowledge, there is no research on how much one year increase in the retirement age will increase in the LFPR of the corresponding age group.

Based on the corresponding age groups' LFPRs of Japan, Korea, G7 countries and OECD countries in 2011, we assume that the LFPR for female group 50-54 will increase linearly from 62.4% in 2010 to 70% in 2019 which is the level of the OECD countries in 2011 (Table 3). The LFPR for female group 55-59 will increase linearly from 53.8% in 2010 to 59.0 in 2019 which is slightly below the average level of the OECD countries in 2011. For the male group 60-64, their LFPR will increase linearly from 58.3% in 2010 to 70.0% in 2019 which is lower than Korea and Japan's level in 2011 and higher than both the G7 and the OECD countries' level in 2011. The main reason for the low LFPR in the G7 and the OECD countries for the male group 60-64 is their well-developed pension system. With the increase in the Age Pension age in the G7 countries in recent years and near future, we expect the LFPR for this age group in these countries will increase². From 2020 to 2030, the LFPR for the female age groups 50-54 and 55-59 and male group 60-64 will keep their new levels at 2019.

The increase of the LFPR of these age groups will increase ALFP and therefore the total size of the labour force. Figure 5 shows that ALFPR will increase to 77.18% in 2015 while the old ALFPR is 76.98%. In 2019, the new ALFPR will be 78.11% which is a 1.5% increase when we compared with the old ALFPR (76.95%). The new ALFPR will be 75.91% while the old ALFPR is 74.58%. The increase in the ALFPR will result in an increase in the total labour force. Figure 5 shows that there will be 1.95 million more labour supply with the new ALFPR in 2015 when we compared the labour force with the old ALFPR. In 2030 there will be 12.95 million more labour supplies with new ALFPR than that with the old ALFPR. The increase in the ALFPR will delay the decline of the total size of labour force from 2016 to 2021 (Figure 6).

What are the economic implications of the increased labour force participation rates? We will use a dynamic general equilibrium model to simulate the effects.

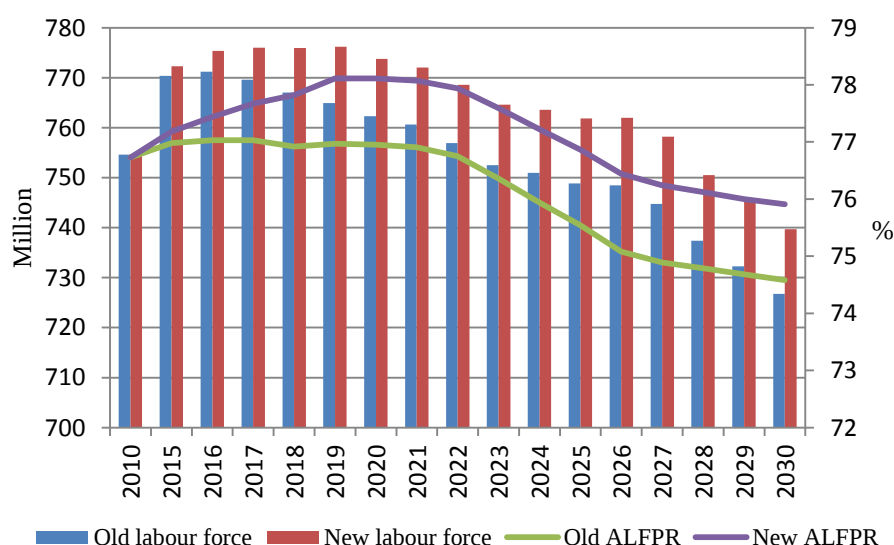
² For example, Australian government announced in 2009 that the Age Pension age will increase from current 65 years to 65.5 years in 2017, and then in six month increments every two years, until it reaches the age of 67 in 2023 (SuperGuide, 2013). The United States, Iceland, Norway and Denmark currently have, or are moving towards retirement age of 67. The United Kingdom is increasing the Age Pension age to 68(SuperGuide, 2013).

Table 3: LFPR, China and other OECD countries

Year	2010	2011	2015	2016	2017	2018	2019
50-54 women							
China	62.4		63.85	65.34	66.8	68.41	70.0
Japan		72.58					
Korea		62.03					
G7 countries		75.01					
OECD countries		69.78					
55-59 women							
China	53.8		54.8	55.82	56.86	57.92	59.0
Japan		63.82					
Korea		54.04					
G7 countries		65.68					
OECD countries		59.61					
60-64 men							
China	58.3		60.47	62.72	65.06	67.49	70.0
Japan		75.61					
Korea		72.22					
G7 countries		56.72					
OECD countries		55.32					

Source: data for Japan, Korea, G7 countries and OECD countries from OECD online database (2013). Data for China from National Bureau of Statistics of China, 2012. *China 2010 national population census tabulations.*

Figure 6: Total labour force and ALFPR with and without the increase in LFPR



4. Modelling framework and labour market module

4.1 CHINAGEM

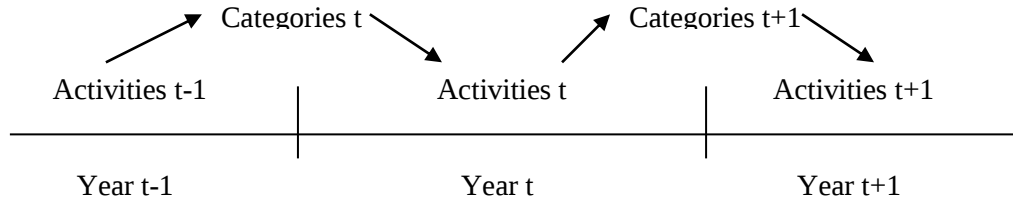
The model we used in this paper is CHINAGEM – a dynamic model of the Chinese economy. It includes 137 sectors and its base data reflects the 2002 input-output structure of the Chinese economy. The core CGE structure is based on ORANI, a static CGE model of the Australian economy (Dixon et al 1982). The dynamic mechanism of CHINAGEM is based on the MONASH model of the Australian economy (Dixon and Rimmer, 2002). The CHINAGEM model captures three types of dynamic links: physical capital accumulation; financial asset/liability accumulation; and lagged adjustment processes in the labour market.

In CHINAGEM, production is modelled using nested constant elasticity of substitution (CES) and Leontief production functions which allow substitution between domestic and imported sources of produced inputs and between labour, capital and land. The production functions are subject to constant returns to scale. Household demand is modelled by the linear expenditure system (ELES). Trade is modelled using the Armington assumption for import demand and a constant elasticity of transformation (CET) for export supply. China is considered as a small open economy in import markets where foreign import prices are determined in world markets. Exports are demanded according to constant-elasticity demand curves for most of commodities. In the model, capital stock is accumulated through investment activities (net of depreciation). Investors respond to changes in expected rate of return.

4.2 Labour market module

Since the effects of retirement age extension on urban labour market may be different with the effects on rural labour market, we introduced a labour market module into CHINAGEM which captures the specific features of China's labour market. Two crucial concepts in the SICGE labour market module are categories and activities of labour supply. At the start of year t , the person-years of labour that will be available during the year are allocated to categories of labour supply. The categories are determined mainly on the basis of employment during the preceding year ($t-1$). Activities in year t are what people do in that year. The relationship between activities and categories is illustrated in Figure 7.

Figure 7: Labour market dynamics



The labour market module contains ten labour supply categories: five employment categories, three unemployment categories, and two new entrant categories (Table 4). The first eight of these categories are associated with corresponding activities. For example, the category AG for year t refers to the number of person-years of employment in rural agriculture in year $t-1$ that is still available for employment in year t . The activity AG for year t refers to the number of person-years actually absorbed in rural agricultural employment in year t . Most of the AG-category labour in year t is employed in activity AG in year t . However, some AG category labour may flow to other activities, and some labour from other categories may flow to the AG activity.

Different categories have different labour supply behaviour and there are different degrees of mobility between categories. We treat the entire rural labour force as unskilled workers and we assume that all rural employment and unemployment categories can only make offers to work in rural activities (AG, RNAG, and RUE) because of China's residential registration (hukou) system. But rural new entrants (NRUR) can make offers to rural as well as urban activities. This is based on the assumption that some urban enterprises recruit new entrants from rural areas and grant them urban residential status. Rural new entrants with university degrees may acquire a job in a skilled urban occupation and obtain urban residential status. For the urban labour force we disaggregate into two employment categories, urban skilled employment (USE) and urban unskilled employment (UUSE); one unemployment category (UU); and one new entrant category (NURB). We assume that urban categories make offers only to urban activities (UUSE and USE). We assume no voluntary unemployment in China. Consequently, no category makes offers to unemployment. We summarized the labour supply categories and activities in Table 4.

The number of persons employed in an activity in the current year is determined by the

demand for and supply to that activity. Those who make an offer to an employment activity but do not get a job in that activity will be forced back to their previous employment activity or to the relevant unemployment activity.

The labour market module of the CHINAGEM model has the following equation blocks:

- demand for and employment of labour by activity;
- supply of labour by category;
- wage adjustment reflecting the gap between demand and supply;
- the determination of everyone's activity in year t ; and
- linking the number of people in activity o in year t to number of people in category c in year $t+1$.

Please refer to Mai *et. al* (2013) for the detailed equations of the labour market module.

Table 4: Categories and Activities

Employment categories and activities	
AG	AG riculture - Person-years of employment in rural agriculture sectors with rural residential status
RNAG	R ural N on- AG riculture – Person-years of employment of rural people in non-agriculture industries within their township of residence, such as in township and village enterprises and private enterprises in rural areas
RUE	R ural- U rban E mployment – Person-years of employment of rural people in non-agriculture industries outside of their township of residence
UUSE	U rban U n S killed E mployment – Person-years of employment of urban people in unskilled occupations
USE	U rban S killed E mployment – Person-years of employment of urban people in skilled occupations
Unemployment categories and activities	
RAGU	R ural AG ricultural U nemployment – Person-years spent by rural workers without a job in their township of residence
RUU	R ural- U rban U nemployment – Person-years spent by rural workers without a job outside their township of residence
UU	U rban U nemployment – Person-years of urban labour force that are not employed
New entrants categories (no corresponding activities for these categories)	
NRUR	N ew entrants RUR al – Person-years of new entrants into labour force with rural residential status
NURB	N ew entrants URB an – Person-years of new entrants into labour force with urban residential status

5. Baseline scenario

To analyse the economic effects of the retirement age extension, we first develop a baseline scenario - a business-as-usual scenario without the implementation of the policy change³. Then we conduct a policy simulation, an alternative forecast with the change in the retirement age. The effects of the policy change are measured by deviations of variables in the alternative forecast from their baseline levels.

Table 5: Summary of baseline calibration*

	2012	2015	2020	2025	2030
<i>Exogenously specified variables</i>					
<i>Annual growth rate (%)</i>					
Investment	10.08	10.45	9.47	8.05	6.71
Consumption	6.42	6.65	6.03	5.13	4.27
Labour force	0.35	0.21	-0.34	-0.28	-0.75
<i>Output of</i>					
Agricultural sectors	3.74	3.9	3.57	3.04	2.55
Industrial sectors	8.72	9.10	8.33	6.42	5.4
Service sectors	7.9	8.24	7.54	7.08	5.95
<i>Calibrated results</i>					
<i>Annual growth rate (%)</i>					
Real GDP	7.7	8.08	7.46	6.44	5.43
Capital stock	10.7	10.62	10.13	9.12	7.83
Real wage rate	10.42	10.20	9.29	7.77	6.93

Source: Baseline simulation results. * Only selected years results are displayed in this table.

To develop the baseline scenario, we first update the model's database to 2011. Then for the forecast period of 2012 to 2030 we assume that the growth pattern of the Chinese economy will follow its historical trend but will grow at a lower rate (for example, the average annual growth rate of real GDP between 2002 and 2007 is 10.3 per cent while we assume that the average growth rate of real GDP from 2012 to 2015 is 8 per cent, from 2016 to 2020 is 7.5 per cent, from 2021 to 2025 is 6.5 per cent and from 2026 to 2030 is 5.5 per cent.. Meanwhile, we assume that the service sector will increase faster than the industrial sector from 2021 and the import will increase faster than the export from 2016. The growth rates of rural migrant workers and other labour categories in the baseline scenario are endogenized and determined by the exogenous macro variables such as investment, export and import, the growth rates of agricultural, industrial and service sectors, and the growth rate of total

³ For more detail about how the business-as-usual scenario is developed for the SICGE model, see Mai 2006.

labour force (refer to Table 5 for the baseline results).

The growth rate of the exogenous variable, total labour force, is calculated based on the growth rate of working age population and the aggregate labour force participation rate (please refer to Table 2) we calculated in section 3 where we assume that the cohort labour force participation rates will remain their 2010 level until 2030.

6. The effects of retirement age extension

This section contains an analysis of the economic effects of raising the retirement age. In section 4 we assume that the Chinese government will gradually increase both male and female workers' retirement age from 2015. As a result, the labour force participation rates of female age groups 50-54 and 55-59 will gradually increase from 62.4% in 2010 to 70% in 2019, and from 53.8% in 2010 to 59.0 in 2019, respectively. For the male group 60-64, their LFPR will increase gradually from 58.3% in 2010 to 70.0% in 2019. From 2020 to 2030, the LFPRs for these three age groups will keep their new levels at 2019. The corresponding increase in the size of labour force from 2015 to 2030 has been calculated and displayed in Figure 5. In the policy simulation we assume that the retirement age extension policy is implemented in five years from 2015 to 2019 and we assume that this policy is only applicable to urban unskilled and urban skilled workers. The extension in the retirement age is simulated by increasing the labour supply of both urban unskilled employment (UUSE) and urban skilled employment (USE) categories from 2015 to 2019 with an average growth of 0.35% annually.

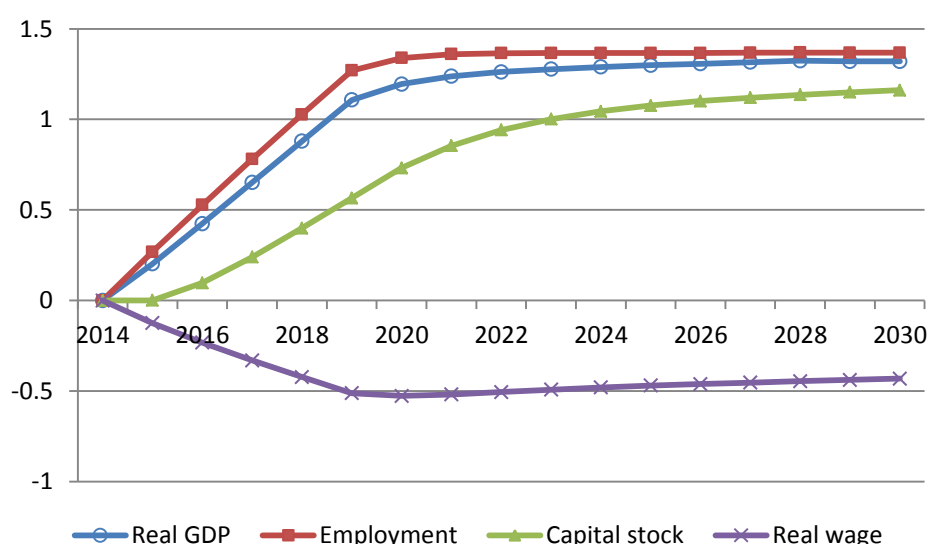
6.1 Real GDP and other macroeconomic indicators

The increase in the labour supply will boost China's economic growth. Figure 7 shows that in the long-run, real GDP will be 1.32 per cent higher than that of baseline scenario. There are two reasons for the higher real GDP. First, the increase in the labour supply as a result of extension of retirement age contributes to the growth of real GDP. The increase in the labour supply will have downward pressure on the real wage of the economy. The decline of the real wage will stimulate the increase in the employment. Figure 8 shows that by the end of 2030, the effective labour input will be 1.37 per cent higher than that of the baseline scenario. Secondly, higher capital stock contributes to higher GDP growth. In the long run aggregate

capital stock will be 1.16 per cent higher than that of baseline scenario (Figure 8). The long-run increase in capital stock relative to baseline is due to the increase in the employment. We notice that deviation of capital stock with baseline scenario is lower than that of labour input. The reason is that the increase in the labour supply will reduce the growth rate of real wage. By the end of the simulation period, the real wage will be 0.43 per cent lower than the baseline scenario. The declining growth rate of real wage comparing with the baseline scenario implies that labour is becoming cheaper and the industries will have intention to substitute capital with labour, which will reduce the capital –labour ratio of the economy in the long run. The substitution between capital and labour will slow down the growth rate of capital stock.

Figure 8: Simulation results: real GDP, factor inputs and real wage

(Percentage deviation from baseline)



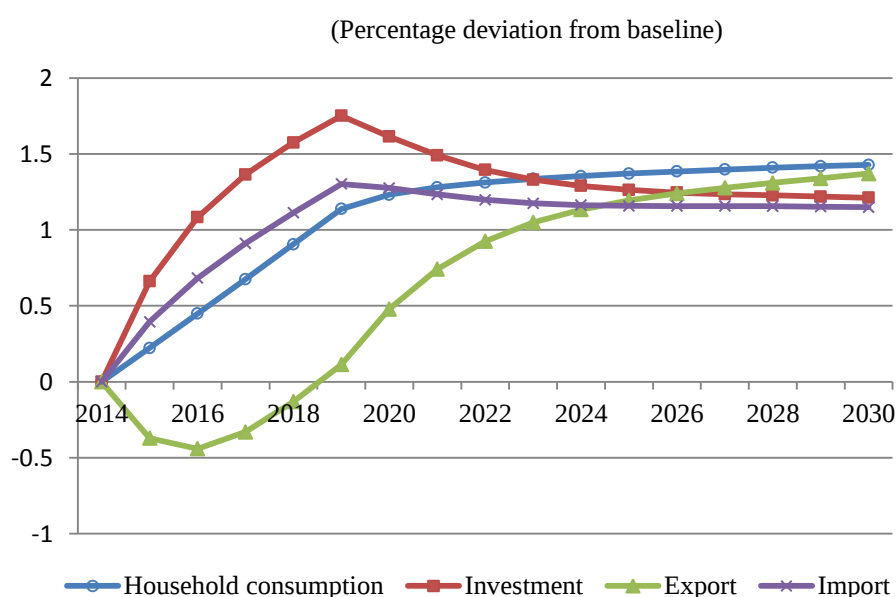
6.2 GDP Expenditures and household income

Due to the strong increase in capital stock, aggregate investment increases strongly relative to its baseline path (Figure 9).

In the long-run the increase in the labour supply stimulates the growth of China's exports. As Figure 8 shows, exports will be 1.37 per cent higher than in the baseline scenario. The reason is that with the slower growth of the wage rates of workers, the labour cost in export sectors, especially in manufacture sector is reduced. This further increases the competitiveness of

Chinese exports in the world market. As a result Chinese exports expand. The expansion of exports implies more employment opportunities which may further stimulate the development of export-oriented sectors in China. However, in the short- to medium-run when capital stock is being accumulated, export performance is damped by real appreciation associated with an increased level of investment activities (Figure 10). In the long run, further expansion in the export will result in a real devaluation of RMB relative to the exchange rate path of the baseline scenario. Figure 10 shows that the value of RMB is 0.53 per cent lower than in the baseline case.

Figure 9: Simulation results: Expenditure-side of GDP



The increased labour supply also improves households' living standards measured by real consumption. As Figure 8 shows, real household consumption is 1.43 per cent higher than in the baseline scenario. We also notice that the increase of consumption is higher than that of real GDP. One reason is the decline of the price of the consumer goods. Figure 10 shows that the consumer price index will be 0.24 per cent lower than that in the baseline scenario. Why is the consumer price index lower in the policy scenario? The reason is that the increase in the urban unskilled and skilled employment boosts the growth of outputs of not only industrial and services products but also the output of agricultural products. Figure 11 shows that the agricultural output is 0.74 per cent higher than in the baseline scenario. The growth of agricultural output will reduce the food price and therefore the consumer price index will be lower in the policy scenario than in the baseline scenario.

Figure 10: Simulation results: price indices, terms of trade and real devaluation

(Percentage deviation from baseline)

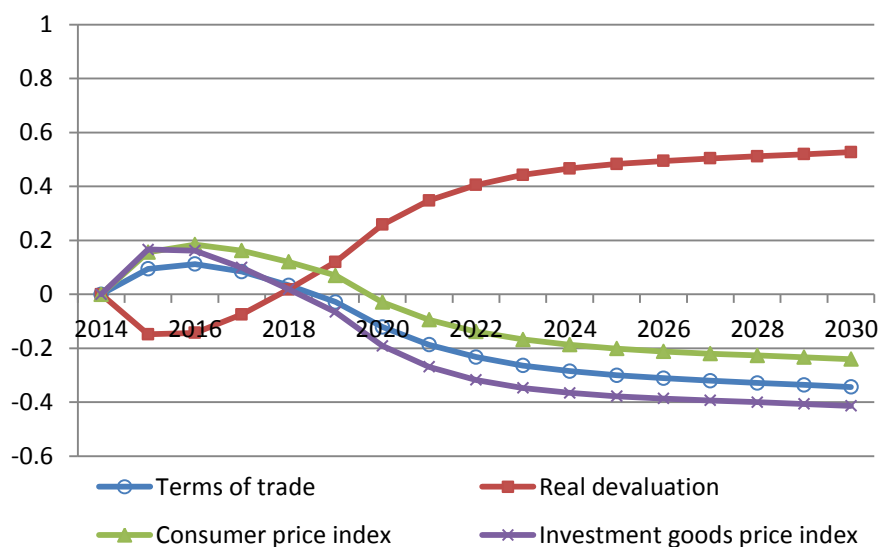
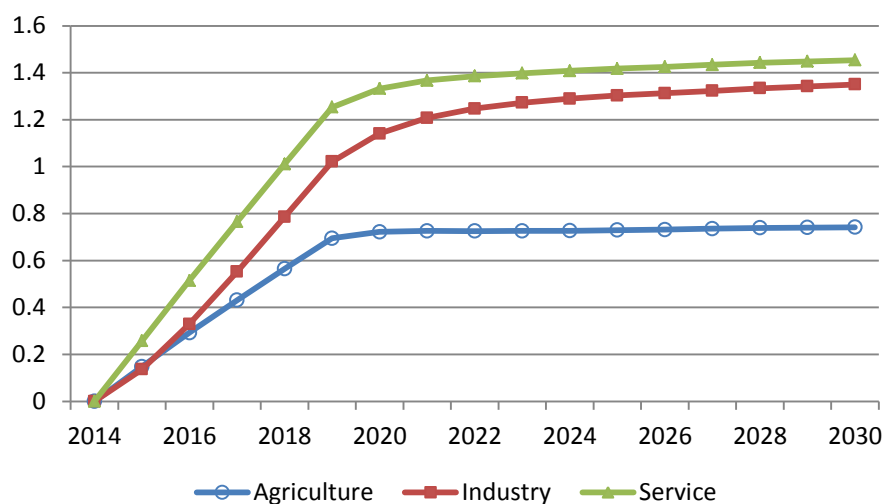


Figure 11: Simulation results: outputs of three aggregate sectors

(Percentage deviation from baseline)

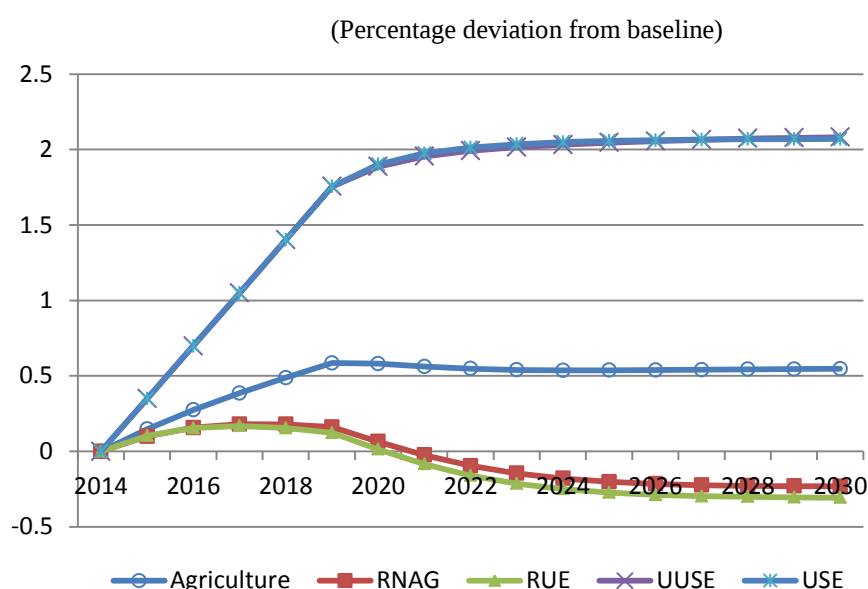


6.3 the effects on labour market

With the extension of the retirement age, the labour supply of urban unskilled and urban skilled workers will increase. As a result, their real wage rates will decline (Figure 13. The real wage rates of urban unskilled and urban skilled labours will be 1.5% and 1.7% lower than in the baseline scenario, respectively) and employment of UUSE and USE will increase (Figure 12. The UUSE and USE will be 2.1 per cent higher than in the baseline scenario).

What are the effects of the increase in the urban employment on the rural labour market? Figure 12 shows that employment of agricultural workers will also increase (AG) (agricultural employment will be 0.5% higher in the policy scenario than in the base case); while the employment of rural non-agricultural (RNAG) and rural-urban migrant (RUE) workers will increase in the short to medium run and it will decline in the long run.

Figure 12: Simulation results: employment of five labour categories



The reasons for the increase in agricultural employment are:

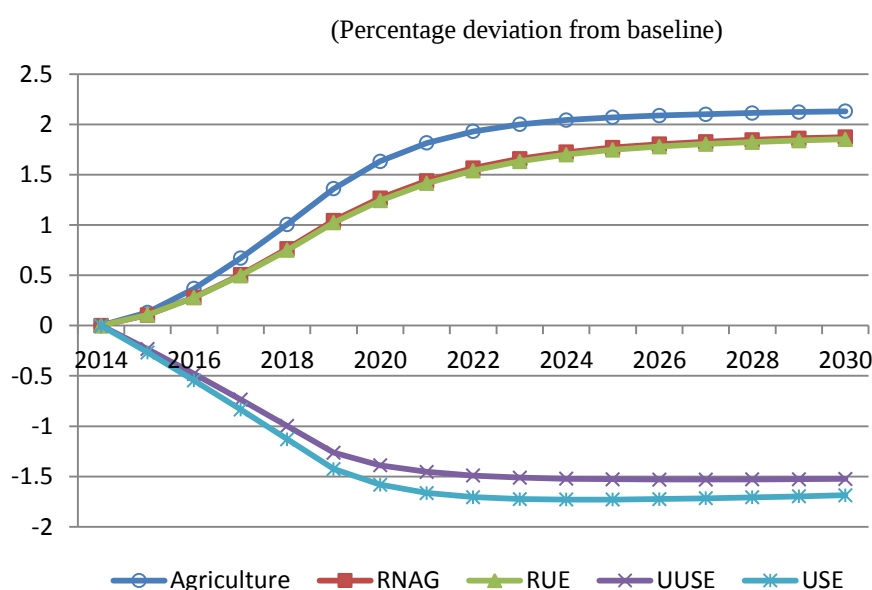
First, the employment increase in the urban sectors as a result of increased labour supply in the urban unskilled and skilled labour categories boosts the economic growth which will result in an expansion of all the sectors including agricultural sector.

Secondly, labour becomes cheaper relative to the capital because of the real wage decline caused by the increased labour supply in the urban market. As a result, all economic sectors have an intention to increase their labour demand. The whole economy will become more labour intensive in the long run compared with the baseline scenario.

As a result of increase demand for agricultural employment, the real wage of agricultural workers increases. Figure 13 shows that by the end of 2030, real wage of agricultural workers will be 2.1 per cent higher than in the baseline scenario.

The reasons for the increases in the labour demand for rural non-agricultural and rural-urban workers in the short to long run as shown in the Figure 12 are the same as for the agricultural worker, but plus one more factor. The RNAG and RUE workers are mainly working at the more labour intensive sectors, such as manufacture and construction sectors. The rapid increase in the investment in the short to long run as a result of growth of employment and capital stock stimulates the growth of the construction, manufacture and other investment – related sectors which will increase the labour demand in these sectors and push the real wage rates of RANG and RUE workers up. However in the long run, the substitution between urban unskilled labour (declining wage rate) and RANG and RUE workers (increasing wage rate) will reduce the demand for the RANG and RUE workers and therefore stop the further increase of their real wage rates. Figure 12 shows that RNAG and RUE employment will be 0.23% and 0.31% lower than in the baseline scenario in 2030.

Figure 13: Simulation results: real wage rates of five labour categories



7. Conclusion and further study

China will expect a rapid population ageing in the next decade. The fast increase of old population combining with an expected decline of working age population is causing

increasing concern about the sustainability of China's economic growth. The low retirement age will further reduce the size of the labour force and put high pressure on the pension fund. Raising the official retirement age is one of the strategies to encourage labour force participation and increase labour supply. This paper estimates the effect of retirement age extension on the supply of the labour, and therefore on China's economic growth over the period of 2010 to 2030.

Using a dynamic CGE modelling approach, we found that by 2030, an extension of the retirement age will:

- Increase the effective labour input by 1.37 Per cent;
- Increase China's real GDP by 1.32 per cent;
- increase households' real consumption by 1.43 per cent;
- increase China's capital stock by 1.16 per cent;
- increase China's export by 1.37 per cent; and
- Decrease the real wage of the whole economy by 0.43 per cent.

The increase of the labour supply of the urban skilled and unskilled workers resulting from the retirement age extension will decrease the real wage of the urban workers. However, the expansion of the whole economy including agricultural, industrial and service sectors as a result of increased employment in the urban sectors will increase the demand for rural workers which will push their wage up. To summarize, the retirement age extension will boost the growth of China's economy and urban sectors will benefit more than the rural sectors.

The next step of the research will be calculating the effects of the retirement age extension on the pension fund. A pension module has been developed to calculate how much the contribution will be increased and how much the payment will be reduced after the retirement age extension. Currently we are verifying the key data used in the module. A research report about the effects of retirement age extension on China's pension fund will be available soon.

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