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**Age Structural Transitions and
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Abstract

China is the most populous country in the world. In less than 50 years since 1950, the Chinese population has experienced the typical process of the demographic transition with fertility falling quickly from high to low levels. In between, sizeable bulges and troughs in age structure were left as results of China's turbulent course of social and economic development in recent decades. The government sponsored birth control programs are believed to have played a special role in pressing down fertility since the mid-1970s. Projections of age structural transition show that the best "window of opportunity" for China as a whole will arrive in around 2010, when the share of working age population reaches the highest level of 70.7% and total dependency ratio drops to the lowest level of 41.5%. However, marked differences exist between provinces and between urban and rural areas. Before the dependency ratio starts to pick up again around 2015, China still have over 10 years' time to make full use of the "demographic bonus". It is a crucial period for China to reach its target of 2020 to quadruple its per capita GDP based on 2000 and to fulfill its commitment to the Millennium Development Goals. Major policy implications are discussed to labor market and social security programs.

1. Age structural transitions: trends and phases

Age structural transitions usually refer to the gradual process of a "young" population moving to an "aged" one as a result of changes in age structure over time. In a relatively closed population where emigration and immigration are relatively small, age structure is shaped largely by the changes in fertility and mortality. In modern times, according to the classical theory of demographic transition, both the mortality and fertility of a population will decline from high to low levels in the course of modernization. The population starts to age as the proportion of children falls and that of the elderly rises.

Cowgill and Holmes (1970) have proposed that populations should be considered as "young" when the proportion of the population aged 65 and over remains under 5%, and should be considered "aged" when the proportion of the elderly reaches 10%. It is believed that 65 is an age when a large segment of the population has significant physical, economic and social needs. However, the document of the 1982 World Assembly on Ageing suggests that it is practical to take 60 years and over as the criterion of the elderly in developing countries where elderly mortality is still high (UN, 1994). In China, for example, the cut-off age for the elderly is set at 60 in most official publications.

It is believed that almost every country in the world is moving from a "younger" population to an "older" one in the era of modernization and globalization. However,

countries may find themselves not only at different stages of modernization, but also at different stages of age structural transitions. By using a range of countries, Pool (2000) outlined a possible framework to see age-structural transitions as passing through different phases, as in the demographic transition model.

Phase 1: The *Phase of Simple Momentum*, most typically of accelerating momentum, where into the foreseeable future larger and larger birth cohorts will work their way across the age structure.

Phase 2: The *Phase of Population Waves*, at which stage most countries of the World are found today. This is generated by a shift from accelerating to decelerating momentum, and that may take the form of one simple wave, or followed by second and subsequent oscillations.

Phase 3: The *Phase of Ageing* when there may still be growth from momentum, or stationarity, or negative natural increase, and also oscillations.

Most developed countries have entered Phase 3, where demographic transition is almost completed at very low levels of fertility and mortality. Most developing countries, on the other hand, are still in Phase 1 or Phase 2, because fertility in these countries started to decline only recently. Nevertheless, projections indicate that age structural transitions will proceed in future much more rapidly in developing countries than it did in developed ones.
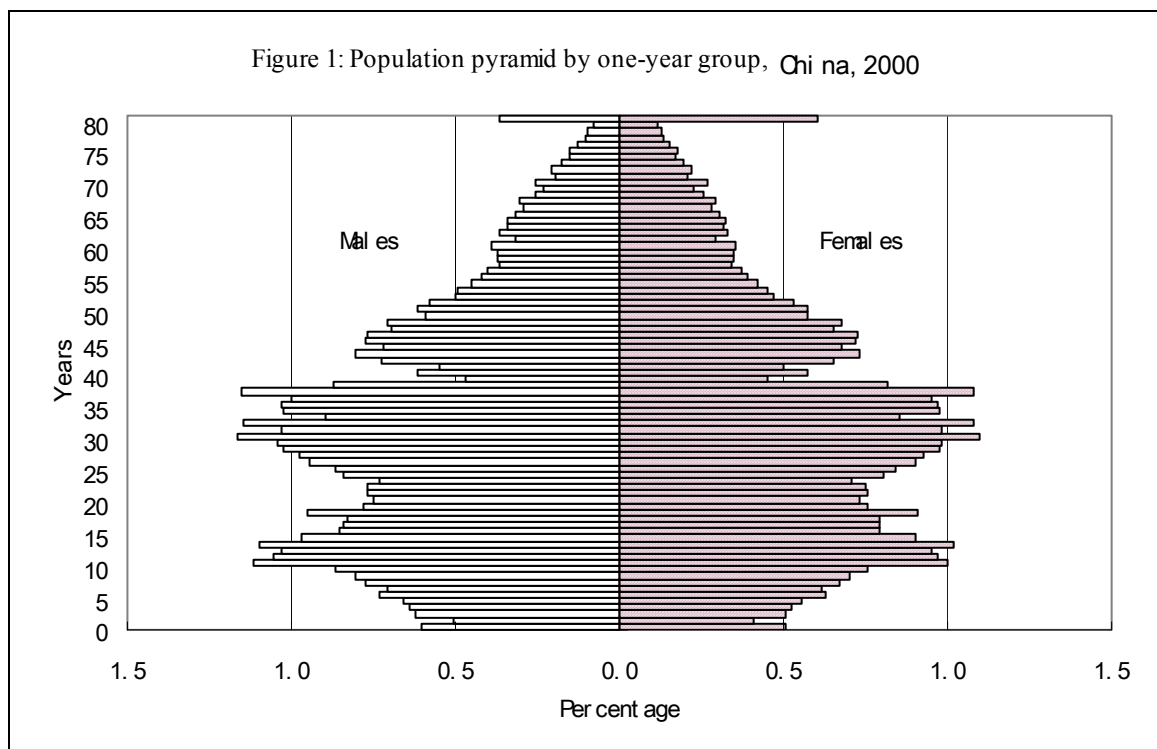
The demographic transition theory makes its unique contribution by indicating the general trend and direction of fertility and mortality changes in the course of modernization. However, the general trend of fertility decline does not necessarily rule out short-term fluctuations that may influence the age structural transition of a population for decades. In fact, most countries, developed and developing alike, have in this century experienced to various extent fluctuations in fertility rather than smooth growth or decline. Such fluctuations or disordered cohort flows, that left more people in some cohorts or fewer in others, have not only direct impact on population age structure, but also far-reaching policy implications that governments and the society have to deal with seriously.

2. Age structural transitions as shown in China's population pyramids

Figure 1 gives China's population pyramid of 2000 based on the one-year age group data of the 5th National Census. In the first glance one can easily detect three apparent bulges separated by two troughs and one contracting base. These bulges and troughs have greatly shaped China's population age structure so far and are going to influence the population's age structural transitions in future.

As shown in Figure 1, the age structure of the population 60 and over shows a rough equilateral triangle, a typical shape for a population under stable growth. It reflects a situation, or years before 1940, where population growth was relatively smooth, with each cohort followed by a larger one. The triangle does not give any obvious hints of fluctuations in births and deaths alike, no matter how the actual rates were at that time. Of course, the top shrinks quickly as the elderly start to die out.

The age structure of the population 55-59 looks typical for a population under static growth. It reflects a situation, or the period 1941-1945, where population growth more or less stagnated, with each cohort followed only by a barely larger one. Obviously, this slow growth has little to do with the effect of modernization proposed by the demographic transition theory. In fact, it can only be attributed to the chaos and social turbulence during the Anti-Japanese War period when excessive deaths were caused.

Figure 1: Population pyramid by one-year group, China, 2000

Source: Constructed from the 5th National Census data, SSB, 2002.

As the age structure of the population 45-54, a broad based triangle, shows, the growth began to pick up after 1946, with each older cohort being outnumbered by a younger one. The broad base indicates that the growth accelerated quickly during the 1950s, a period when China made great progress in economic development since the founding of the People's Republic in 1949. Chinese demographers usually call this first demographic bulge, and the people born during the period 1950-1958 as the first wave of China's baby boom generation.

The sudden trough of the age groups 38-41 reflects the severe impact of the

1959-1962 famine on China's population growth. From 1958 to 1961, for example, TFR dropped from 5.5 to 3.3 and the number of survived births from 12.9 million to 7.3 million. Since the pyramid only reflects the age structure of the survivors, its shape has also been affected by the abnormally high death rate during the famine period, particularly among infants and children.

As the country recovered from the famine, another wave of baby boom took place since 1963, as seen from the bulge in the age groups 25-38. Compared with the first wave, the second wave of baby boom not only lasted longer, but also resulted in the largest cohorts in China's history. On average, the annual total births reached 25 million during the period 1963-1975. It is interesting to notice that the second wave of baby boom forms a shape that looks just in opposite to the first one: the former has a narrower top and broader base and the latter a broader top and a narrower base. The narrower base indicates that the number of births started to decline in early 1970s when family planning programs were introduced gradually.

The second trough can be observed in the age groups 15-24, encompassing the people born during the period 1976-1985 when the controversial One-Child policy was implemented. It is estimated that women in each year during this period gave 5 million fewer new births than the period 1966-1974.

In the age groups 10-14 another bulge took shape from 1985, named by some Chinese demographers as the third wave of baby boom. Two factors are believed to have played a role. The first is a policy factor, as the One-Child policy was not implemented as forcefully as in the early 1980s, particularly in rural areas. The second is the "echo factor" or the secondary momentum effect, when baby boomers started entering childbearing ages. Even in times of low fertility, a large parent cohort is likely to produce a large child cohort. However, it seems that the "echo" was not taken place at the replacement level, since the third wave looks much smaller than the second one.

The pyramid starts to shrink at the base from age group 10, because the smaller parent cohorts born during the climax years of the One-Child policy began to have their own children. It is interesting to note that the number of children is smaller than that of their parents, indicating that the parent cohorts might have a below-the-replacement fertility as well. What we know is that no tough birth control measures were taken in this period. An educated guess is that the modernization factor might have started to take effect, since the 1990s is the period when China experienced rapid economic growth and marked improvement of people's living standard. Another point worth noticing during this period is the rising sex ratio among new births, from 1.09 of the group 10-14 to 1.15 of the group 5-9 and further to 1.20 of the group 0-4. The imbalance between boys and girls may have important policy implications as same as age structural transitions in future.

In the next 5-10 years, it is predicable for us to see another rise in the number of

new births, when the third wave of baby boomers enters child-bearing ages. It is uncertain, however, if the below-the-replacement fertility can be kept, since many local governments are considering possible changes in their birth control policy to allow only-children couples having two children. Even at the replacement level, we can still be sure that the percentage of children under 14 will continue to decline and that of the elderly will go up, leading to a gradual ageing of the population as a whole.

While discussing the impact of fertility fluctuations, caution should be taken to choose a proper population pyramid. Figure 2 gives China's population pyramid by five-year age group, where the impact of baby boom over the last few decades can still be clearly observed. However, in comparison with the pyramid by one-year age group in Figure 1, the first trough, or the impact of the famine-induced fertility decline during the period 1959-1962, almost disappears from Figure 2. The reason lies in the fact that people born during the famine have been clustered into separate five-year age groups with their large neighboring cohorts. Comparisons between census data should take additional cautions, because China's four previous censuses were conducted not in every five or ten years, but in 1953, 1964, 1982 and 1990, separately. If five-year age groups are preferred in analysis, birth cohort of a specific year may not be grouped with its neighboring cohorts consistently in the same five-year group from one census to another. Therefore, the changes in pyramid shape between censuses do not necessarily represent the changes in a specific five-year cohort over time. To minimize such inconsistencies in comparing census data, the Chinese government has decided to conduct an interim census every five years and a full census every ten years from 1990 when the 4th National Census was completed. A 1% population census was carried out in 1995 and the 5th National Census was conduced in 2000.
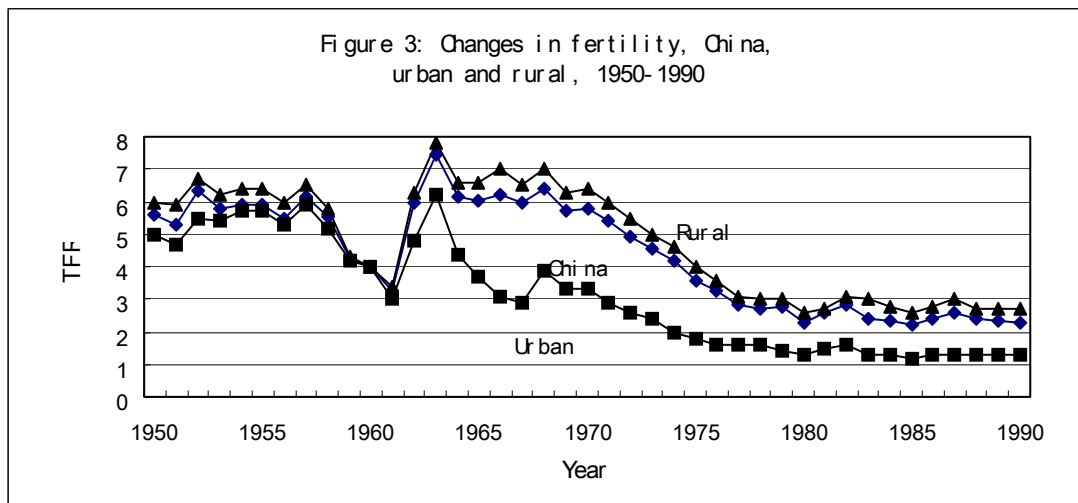

Figure 2: Population pyramid by five-year group, China, 2000

Source: Constructed from the 5th National Census data, SSB, 2002.

3. The baby boom as a result of rising fertility and falling mortality

The three baby boom waves have played a major role in shaping age structural transitions in China. Baby boom or a boom of babies can be attributed to two major factors: a large number of women in childbearing ages or an extraordinary high level of fertility, or a combination of the two. It is believed that high fertility, not large numbers of women, has been the crucial determinant of the baby boom in China. However, unlike the case in many industrialized countries after the World War II where infant mortality rate remained consistently low during the pre-baby boom and the baby boom period, the baby boom in China can also be attributed to a third factor: the falling mortality. Anyway, the discussion here concerns primarily about the number of people who have survived, instead of the number of births. In fact, China's baby boom provides a lively illustration to the demographic transition theory.

Before the on-set of the baby boom in the early 1950s, China remained in a typical pre-transition regime with high fertility, high mortality and low increase. Based on the 1982 National Fertility Survey data, total fertility rates were estimated as 5.2 on average in the 1940s. Since the mortality was also high at that time, ranging from 25-30 per thousand, the real increase rate was quite low. As mentioned in the previous section, China's population increase almost stagnated in the early 1940s.

The founding of the People's Republic in 1949 opened a new chapter in China's modern history. As the national economy recovered quickly from war and famine, people's living standard also improved substantially. The demographic transition theory believes that mortality starts to fall as the society gets increasingly modernized while fertility is kept continuously at a high level. In less than eight years from 1949 to 1957, China's mortality rate dropped from 20 to 10.8 per thousand (Wang, 1985). The infant mortality rate (IMR) dropped during the same period from about 200 to 70 per thousand. As a result, people's life expectancy rose sharply from 34 to 60. It is widely believed that the fast mortality decline, and the decline of IMT in particular, in the early 1950s have made a special contribution to the population growth during this period. For example, TFR increased by about 10% from the average of 5.2 in the 1940s to 5.7 of the 1950s. During the same period, however, the number of survivors increased by one third from 113 million to 170 million, given no substantial rise in the number of women in childbearing ages was observed. In this context, the baby boom in the early 1950s can also be described as a survivor boom.

Figure 3: Changes in fertility, China, urban and rural, 1950-1990

Source: Reconstructed from Fan, 1995.

Figure 3 gives the changes in fertility in China during the period 1950-1990. If taking TFR at 5 as an indicator of high fertility, there have been two periods when fertility was high. The first lasted from 1950 to 1958 with an average TFR at 5.7, representing the first wave of baby boom, and the second lasted from 1963 to 1972 with an average TFR at 6, representing the second wave of baby boom. However, for the two population waves, the causes of fertility decline are quite different. The former wave was interrupted almost suddenly by a famine, while the latter one was pressed down gradually by the government's birth control campaigns. After the famine, we see a quick rebound of fertility to a peak level. In the case of the latter wave, we see no trace of a possible return of high fertility. It might indicate that the era of high fertility has come to an end once and for all in China's history. Figure 3 does not give any hint of the third wave of baby boom as observed in population pyramids. This implies that the third wave of baby boom is not a direct product of high fertility, but largely an echo to the first two baby booms.

The changes in TFR after 1990 are not shown in Figure 3, since official data are not available. The State Statistics Bureau (SSB) and the China Population Information and Research Center (CPIRC) have come up with a number of TFR estimates in recent years. However, none of them have been published in official documents. The only official estimate we have so far for the 1990s is that of 1999 at 1.22, calculated from the 5th National Census data of 2000. However, this estimate is not taken very seriously by many demographers for being unrealistically too low. However, an educated guess is that a near replacement level fertility must not be far from the reality.

4. Age structural changes and the "window of opportunity" in China

A discussion on the age structural transition in China is not possible without mentioning the baby boom generation for two obvious reasons: one is the absolute

number of people involved (520 million, or nearly half of the total population in 1990), and the other is the accelerated momentum for the transition because of baby boomers' presence. Table 1 shows the changes in population age structure, based on census data from 1953-2000 and a CPIRC projection for the period 2000-2050.

When the first national census was conducted in 1953, China had a total population of 587.9 million. Although population increase had stagnated in the 1940s, as discussed previously, the population at the time can still be considered a "young" one, given the large share of children 0-14 at 36.3% and the small share of the elderly aged 65 and above at 4.4%, which is below the 5% mark suggested by Cowgill and Holmes. The ageing index of 12.1% can also serve as a benchmark for the structural changes in later years. The effect of the baby boom starting from 1950 can already be felt, given the fact that 43.4% of the survived children were born during the five years prior to the census. The large share of the young people also keeps total dependency ratio at a high level of 68.6%.

From 1953 to 1964 when the second national census was conducted, China's total population grew by 16.7% from 587.9 million to 705.0 million. During the same period, the number of children increased more rapidly by 26.7% from 205.8 million to 280.7 million, pushing its share in the total population from 36.3% up to 40.7%. These children were born entirely during the baby boom period since the 1950s. Although the elderly aged 65 and over did not vary much in numbers, remaining about 25 million, they have their share in the total population squeezed by baby boomers from 4.4% to 3.5%. The trend can be confirmed also by the ageing index falling to the lowest level of 8.6% and total dependency ratio reaching a peak of 79.2%. This can be seen as a unique stage of age structural transition in China where the population as a whole became 'juvenized' rather than aged.

Table 1. Age distribution by census year 1953-2000, China

Year	Total population	Age group(%)			Total dependency ratio
	(million)	0-14	15-64	65+	
1953	587.9	36.3	59.3	4.4	68.6
1964	705.0	40.7	55.8	3.5	79.2
1982	1,016.5	33.6	61.5	4.9	62.6
1990	1,143.3	27.7	66.7	5.6	49.9
2000	1,267.0	25.4	67.7	6.9	47.7

Source: CPIRC, 2004.

After the second national census, the census routine in China was interrupted by the chaotic Cultural Revolution (1966-1975), causing an 18-year interval before the third national census was conducted in 1982. While the total population increased by 30.3% from 705.0 million to 1,016.5 million from 1964 to 1982, the number of child grew only by 16.8%. It indicates that the massive family planning programs introduced since the early 1970s have started to take effect. During this period, the majority of baby boomers born in the 1950s and the 1960s have entered working ages, resulting a marked increase in the population aged 15-64 and a fall in dependency ration. While the population growth was still dominated by the increase in young people, there were also indications that the elderly were catching up in number and proportion. During this period the total elderly doubled from 24.3 to 49.4 million, and their proportion rose from 3.5% to 4.9%. As a result, the ageing index rose from 8.6 to 14.6%..

When the 4th National Census was conducted in 1990 China's population stood at 1,143.3 million, an 11.1% increase from 1982. For the first time in history, China witnessed a decline in the number of children, due to the enhanced influence of the two major factors that had worked during the previous period: continuous fertility decline and baby boomers' complete entering into working ages. To certain extent, fewer births were also attributed to late marriage and late child-bearing, part of the government's birth control package. During the same period, the number of working age population rose by 18.2%, at a rate higher than that of total population. With the proportion of the elderly exceeding the 5% mark and the ageing index going up to 20.1%, China's population as a whole could no longer be considered as 'young'.

The 5th National Census was conducted in 2000, resulting in a total population of 1,267 million. Compared with 1990, although the total number kept growing, the annual grow rate dropped by 0.3 percentage point from 1.38% to 1.08%. While the share of the 0-14 groups declined by 2.3 percentage points to 25.1%, that of the 65+ group rose by 2.3 percentage point to 6.9%, almost reaching the 7% mark for an "aged" population. At the same time, we see a slight rise in the number of people at working ages 15-64 from 66.7% to 67.7%, resulting in a further drop in total dependency ratio to 47.7%.

Data from the previous five censuses show that China's population are gradually moving from a young population to the early stage of an adult population. As discussed above, the drastic course the demographic transition took over the last few decades has greatly shaped the current population age structure. It is clear that the process of demographic transition in China is far from complete. Even if fertility can be controlled at a low level in future through the joint effect of government intervention and socio-economic development, the total population will still keep growing. The drastic fluctuation caused by the baby boom will also keep repeating itself before finally being ironed out by time.

Population projections can usually provide a reliable illustration how age structural transitions proceed in future. Based on the 5th National Census data of 2000, total population and other relevant indicators have been estimated by CRIRC in 2003 for the period 1990-2050 (see Table 2). The fertility level as represented by the TFR is assumed to increase from 1.87 in 2000 to 2.00 in 2010, and drop to 1.88 in 2030 and 1.83 in 2050. The average life expectancy, on the other hand, will rise from 69.5 for males and 74.3 for females in 2000 to 76.6 for males and 81.8 for females in 2050. Notice should be made here that the cut-off age for the aged population is 60, instead of 65 as used in Table 1.

Table 2. Age distribution by projection 2000-2050, China

Year	Total population	Age group(%)			Total dependency ratio
	(million)	0-14	15-59	60+	
2000	1,267.0	21.7	67.8	10.4	47.4
2005	1,322.0	19.0	70.0	11.0	42.9
2010	**1,377.0**	**16.8**	**70.7**	**12.6**	**41.5**
2015	**1,430.0**	**15.1**	**69.9**	**15.0**	**43.1**
2020	1,472.0	15.1	68.2	16.6	46.6
2030	1,525.0	10.6	66.2	23.3	51.1
2040	1,544.0	11.4	62.0	26.6	61.2
2050	1,522.0	9.5	61.7	28.8	62.1

Source: CPIRC, 2004.

Carvalho (1997) argues that the passage of population waves may provide a "window of opportunity", or what is often termed as a demographic bonus to development, when demographic dependency swings from an orientation towards the youth ages to old age dependency. In between there is a period when the number of people in working ages reaches a peak and total dependency ratio drops to the lowest level. If other factors remain unchanged, a country's economy will certainly profit from a growing labor force and falling expenditure on unproductive segments of the population. Even at family level, the demographic bonus can bring obvious benefits. For example, baby boomers usually have a large number of siblings. It is easy for them to share the responsibility of supporting their parents. On the other hand, baby boomers themselves usually have fewer children. They don't have to spend too much family

resource on child-rearing. The money saved can be used for other options, such as improving quality of life or investment in children's education.

According to the projection results of Table 2, the best "window of opportunity" for China will arrive in around 2010, when the share of people in age groups 15-59 reaches the highest level of 70.7% and total dependency ratio drops to the lowest level of 41.5%. However, China might have already started enjoying the benefits of the demographic bonus since the 1970s and 1980s when the majority of baby boomers entered labor force and total dependency ratio began to fall. For example, in the period 1980-2000, China achieved fast economic growth, with its per capita GDP quadrupled from $200 to $800 and its foreign currency reserve raised from a deficit of $1.3 billion to a surplus of $165.5 billion. These achievements are commonly attributed to the government introducing right policies, such as economic restructuring, market liberalization and opening up to the outside world. Rarely mentioned is the contribution made by growing labor force and falling dependency ratio. This might be an interesting research topic in future for economists and demographers alike.

It is certain that before the dependency ratio starts to pick up again around 2015, China still have over 10 years' time to make full use of the "window of opportunity". The year 2015 is of special significance here because it is a crucial period for the Millennium Development Goals (MDGs), agreed upon by leaders of 189 UN member countries at the Millennium Summit in 2000. It is set as a deadline for improvement in many development goals, such as eradication of extreme poverty and hunger, universal primary education and gender equality. As seen in Table 2, the increase in dependency ratio in 2015 is caused primarily by the rise in the proportion of the aged population (60+). In comparison, the proportion of children (0-14) in fact continues to decline, only hardly to offset the impact of the elderly. Nevertheless, the change in the proportion of working age population 15-59 is negligible. However, the "window of opportunity" is going to close gradually after 2015.

China's age structural transitions will continue over the subsequent years. After reaching the historic peak of 1,544 million in 2040, the total population is expected to decline, as the annual increase rate starts to turn negative. By 2050, the total population will stand at 1,522 million. Because all baby boomers will enter retirement ages during this period, the proportion of the elderly will go up to 28.8%. Compared with the previous period from 1990 to 2020, however, the growth rate of the aged population will slow down, simply because the baby boom effect is gradually fading out. At this level of population ageing, it can be concluded that the age structural transition in China has almost completed.

5. Age structural transitions at the provincial level

China is administratively consists of 23 provinces (including Taiwan), 5

autonomous regions and 4 municipalities directly under the jurisdiction of the State Council. Being a developing country with vast territory, China has long been troubled by the problem of regional disparity in development. In the last two decades of fast economic growth, however, the gap between the advanced coastal regions and the underdeveloped Western provinces is not narrowing but widening. Similar disparity also exists in the area of social progress and development. In this context, the classical theory of demographic transition also applies to the situation inside China. That means, provinces not only find themselves in different stages of development, but also different stages of demographic transition. Judged by Pool's framework of age structural transitions, provinces also find themselves in different phases of age structural transition: a few have already entered Phase 3 of ageing like Shanghai and Beijing, while other are still moving in Phase 2 of population waves, or even the Phase 1 of simple momentum.

Table 3 gives the percentage of population by age group, dependency ratio and per capita GDP by regions. The difference between regions is quite impressive. Taking the proportion of population in working age for example, Beijing has the highest proportion at 77.99%, followed by Shanghai at 76.28%. At the bottom of the table is Tibet and Guizhou, both at around 64%. With the highest proportion of the young at 31.19% and the lowest proportion of the aged at 4.75%, Tibet still lags behind in a pre-transition regime. Judged by dependency ratio, Beijing ranks on the top, with the lowest total dependency ratio at 28.22, which is only half of the highest ratio at 56.58 recorded in Guizhuo. In terms of age structural transitions, however, Shanghai seems more advanced than Beijing, since it has the lowest young dependency ration at 16.07 and the highest aged dependency ratio at 15.02. On the other end, Guizhou and Tibet are still left behind as the most backward regions. If per capita GDP can be taken as an indicator of development, a comparison shows that there might be a roughly negative correlation between dependency ratio and development. The higher the per capita GDP a region has, the lesser burden it has to support its dependent population. For example, Shanghai has the highest per capita GDP at 34,547 Yuan and the lowest total dependency ratio at 31.10, while Guizhou has the lowest per capita GDP at 2,662 Yuan and the highest total dependency ratio at 56.58. Shanghai's per capita GDP is almost 13 times higher than that of Guizhou. Of course there are some obvious exceptions, like the case of Guangdong where per capita GDP is high but dependency ratio is high as well. It seems that other factors of development have to be taken into consideration, such as urbanization, education and women's labor force participation. For example, more urbanized regions, like Liaoning, Jilin and Heilongjiang, tend to have lower dependency ratios. Policy can also make a difference. Although the central government has a national guideline of birth control policy, it is the provincial governments that are responsible to work out local regulations and programs. Some local policies look very tough, while others sound a little lenient with many "exceptions" and "loopholes". As mentioned in above

Table 3: Selected demographic and economic indicators by region, China, 2000

Region	Percentage of population by age group			Dependency ratio			Per capita GDP in RMB
	0-14	15-64	65+	Total	Young	Aged	(Yuan)
Beijing	13.59	**77.99**	8.42	28.22	17.43	10.80	22,460
Shanghai	12.26	**76.28**	11.46	31.10	16.07	15.02	34,547
Heilongjiang	18.89	**75.55**	5.56	32.36	25.00	7.36	8,562
Jilin	18.92	**75.03**	6.04	33.27	25.22	8.05	6,847
Tianjin	16.76	**74.82**	8.41	33.64	22.40	11.24	17,993
Liaoning	17.68	**74.44**	7.88	34.34	23.75	10.59	11,226
Inner Mongolia	21.23	**73.26**	5.51	36.50	28.98	7.52	5,872
Zhejiang	18.06	**73.02**	8.92	36.95	24.73	12.22	13,461
Jiangsu	19.63	**71.52**	8.84	39.81	27.45	12.36	11,773
Shandong	20.63	**71.05**	8.12	40.46	29.04	11.43	9,555
Hubei	22.80	**70.78**	6.42	41.28	32.21	9.07	7,188
Hunan	22.13	**70.40**	7.47	42.05	31.43	10.61	5,637
Fujian	23.01	**70.31**	6.69	42.24	32.73	9.52	11,601
Hebei	22.78	**70.17**	7.05	42.51	32.46	10.05	7,663
Chongqing	21.84	**70.15**	8.01	42.55	31.13	11.42	5,157
Sichuan	22.59	**69.85**	7.56	43.16	32.34	10.82	4,784
Guangdong	24.11	**69.71**	6.17	43.44	34.59	8.85	12,885
Shaanxi	24.94	**68.91**	6.15	45.12	36.19	8.92	4,549
Qinghai	26.85	**68.59**	4.56	45.79	39.15	6.65	5,087
Xinjiang	27.27	**68.06**	4.67	46.93	40.07	6.86	7,470
Yunnan	25.96	**67.95**	6.09	47.17	38.20	8.96	4,637
Shanxi	25.73	**67.94**	6.33	47.19	37.87	9.32	5,137
Gansu	26.93	**67.86**	5.20	47.35	39.68	7.66	3,838
Jiangxi	25.90	**67.83**	6.27	47.43	38.18	9.24	4,851
Ningxia	28.37	**67.15**	4.47	48.91	42.25	6.66	4,839
Henan	25.89	**67.00**	7.10	49.24	38.64	10.60	5,444
Anhui	25.49	**66.91**	7.59	49.44	38.10	11.34	4,867
Guangxi	26.19	**66.51**	7.30	50.35	39.38	10.98	4,319
Hainan	27.43	**65.83**	6.74	51.91	41.67	10.24	6,894
Tibet	31.19	**64.06**	4.75	56.10	48.69	7.41	4,559
Guizhou	30.17	**63.87**	5.97	56.58	47.24	9.35	2,662

Source: SSB, 2001, 2002.

sections, China's "disordered cohort flows" or "severe oscillations" are largely a result of state manipulation through tough birth control policy and programs. Difference in policy enforcement could possibly lead to difference in age structure, as shown in the cases of Guangdong and Sichuan to be discussed later.

Variation in age structural transitions at the provincial level is also reflected in the differed shapes in population pyramid. For example, Figure 4 gives the population

pyramid of Sichuan, Figure 5 gives that of Guangdong, and figure 6 gives that of Shanghai. Sichuan, located in central China, used to be the most populous province in China before Chongqing went independent as a municipality directly under the jurisdiction of the State Council in 1997. In 2000 Sichaun's total population stood at 82.3 million, still the third most populous province following Henan at 91.2 million and Guangdong at 85.2 million. Economically, Sicuan is considered a relatively underdeveloped province, ranking 25 by per capita GDP in China's 31 administrative divisions (excluding Taiwan). Guangdong, in comparison, is located in the more advanced coastal region of South-East China. Although its population size is only slightly higher than that of Sichuan, Guangdong has a per capita GDP over two times higher. Now the wealthiest province in China second only to Zhejiang, Guangdong belong to the provinces that benefit the most from economic restructuring and market liberalization since the early 1980s. Its proximity to Hong Kong also played a supportive role in the development of local economy. Shanghai is the largest and the most advanced city in China, with a total population of 16.4 million and a per capita GDP of 34,547 Yuan. It also has the highest level of urbanization in China, with 63.1% of local population registered as urban.

Taking into account the pyramid of China in Figure 3, we can make an interesting comparison among the four pyramids. Figure 4 shows three population waves as similarly observed in Figure 3, but with even sharper shrinkages. It implies that Sichuan might have been more seriously affected than the country as a whole by the famine in the early 1960s, since fewer survivors are left in age groups 40-44. Also the government sponsored birth control programs might have been more effective in cutting down fertility from mid-1970s to mid-1980s, as seen in the sudden shrinkage in age groups 15-24. As in Figure 3, the third wave can be attributed largely to the "echo effect" of the second wave. In comparison, as shown in Figure 5, Guangdong has experienced just one population wave since the 1950s. The famine of the early 1960s has left little hint and the birth control programs of the 1970s-1980s have only moderate impact. An educated guess is that, either local policies are very lenient or policies have not been implemented as forcefully as in other places. It seems that the real decline in fertility has started in Guangdong only lately. However, the recent rise in sex ratio is somewhat worrying, going from the doubtfully low level of 0.86 of the age group 15-19 up to the quite high level of 1.30 of the age group 0-4. Figure 6 shows that Shanghai has experienced only one population wave like Guangdong. It seems that, after reaching the highest level in the 1950s, Shanghai's fertility started to decline as early as in the early 1960s when government sponsored birth control programs were yet to be introduced. Obviously, the modernization factor has played a decisive role in this context. The later adopted birth control programs only accelerated this process. In 2000, as shown in Table 2, the proportion of children aged 0-14 (12.26%) was only slightly higher than that of the elderly (11.46%). It is believed that the current fertility in Shanghai is far below the replacement level, given that the natural increase rate has become negative for years since 1993 (-0.3% in 2000).

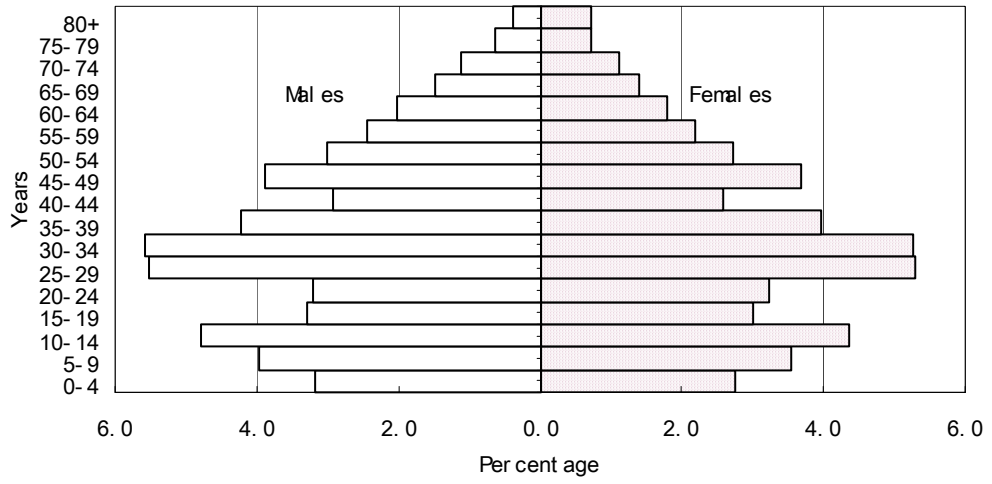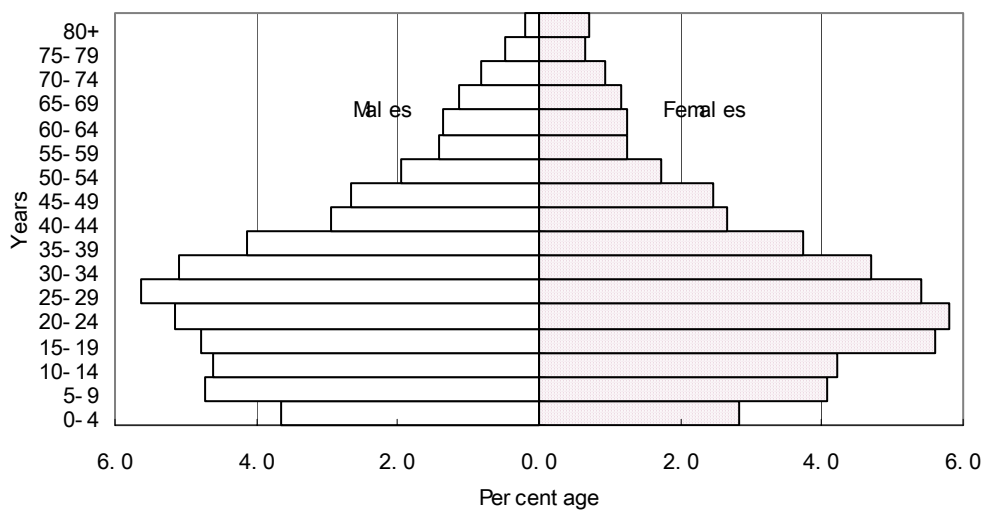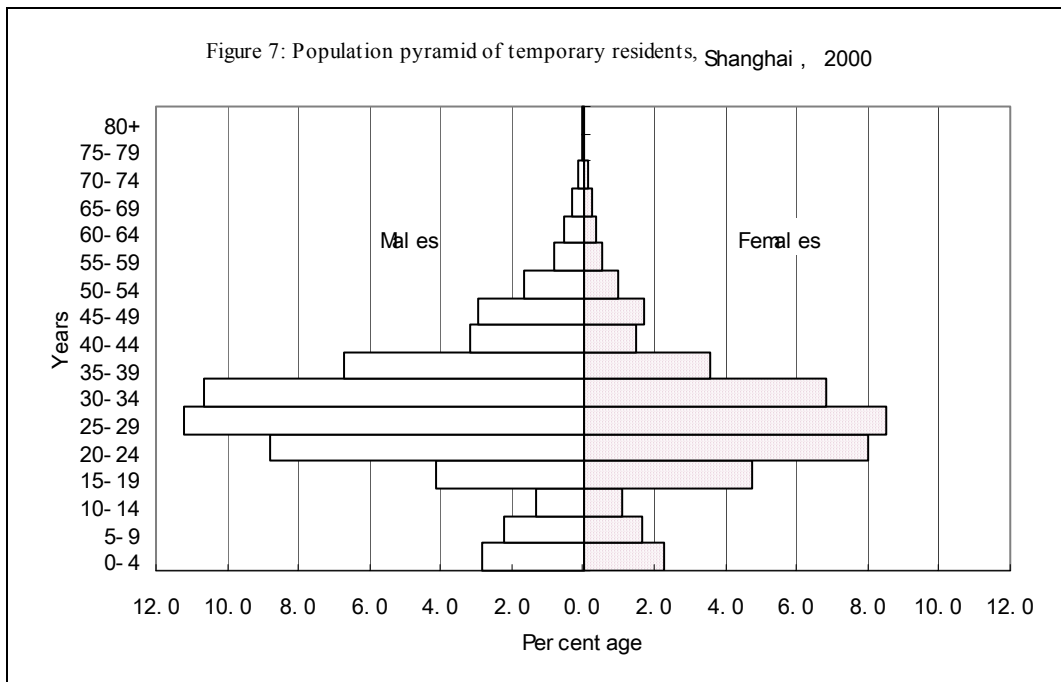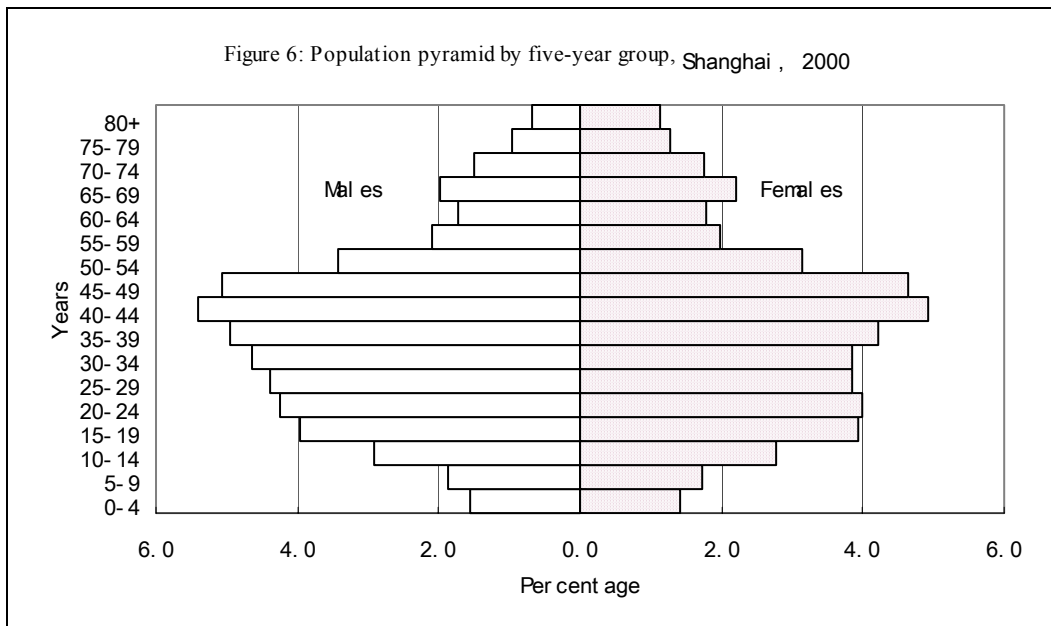Figure 4: Population pyramid by five-year group, Sichuan, 2000

Figure 5: Population pyramid by five-year group, Guangdong, 2000

Figure 6: Population pyramid by five-year group, Shanghai , 2000

Males · Females · Years · Percentage
(axis: 6.0 4.0 2.0 0.0 2.0 4.0 6.0)
(age groups: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+)

Figure 7: Population pyramid of temporary residents, Shanghai , 2000

Males · Females · Years · Percentage
(axis: 12.0 10.0 8.0 6.0 4.0 2.0 0.0 2.0 4.0 6.0 8.0 10.0 12.0)
(age groups: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+)

Source: Constructed from the 5th National Census data, SSB, 2002.

The above population pyramids are constructed based on province-specific data of the 5th National Census of 2000. Included in the census are only residential population officially registered in the province, without counting people of temporary resident status. In reality, a province inside China is not close to people from other provinces. Since the 1980s when the household registration system was relaxed, we have seen massive cross-region migration taking place, mainly from rural areas to urban areas, and from the populous but underdeveloped hinterland provinces to the more advanced coastal provinces. It is estimated that as many as 100 million people are on the move every year, leading to the creation of a new term "floating population" by media.

Understandably, "floating population" in such a huge scale can certainly influence the population's age structure in their origin as well as in their destination. For example, Sichuan is believed to be the main origin of migrant workers and Guangdong the main destination. In Guangdong, it is estimated that migrant workers totaled 15.1 million in 2000, equal to 17.7% of local population. In Shanghai, the number of temporary registration holders is believed to have reached 3.9 million, equal to 23.6% of local population. It is widely observed that migrants consist typically of people young and in their prime, especially young males, as shown in the example of Shanghai in Figure 7. Of all migrants surveyed, 73.6% fall into the age groups 20-49, and 57.6% are males. If migrants are allowed to settle down in Shanghai and given permanent resident status in near future, the age structure of local population will certainly be altered in favor of the young adult and males, adding even more vigor and energy to the already prosperous city.

6. The implication of age structural transitions to labor market

Primarily because of their sheer size (about 46% of the total population in 2000), people born during the high tide of population waves, or baby-boomers, will at each stage of their life cycle influence the population's age structure as a whole. Their impact can be felt also in every aspect of China's social and economic life, particularly in education, employment and old age support as they move over time from school ages through working ages to retirement ages. Discussions in this paper focus mainly on the implications of age structural transitions to labor market and old-age support in China.

The demographic bonus theory argues that, as baby boomers enter working ages en mass, a country can benefit economically from a rise in labor force and a decline in dependency ratio. The decline in dependency ratio is of course good news for everybody. However, the increased labor force does not necessarily lead to economic growth automatically. It is common knowledge that labor is only part of the production equation. For better economic results, also needed is the contribution of other elements like land (natural resources), capital and technology. If not properly allocated and fully utilized, there is going to be a mismatch between labor and other productive factors or an imbalance between demand and supply on labor market, leading to the unwanted phenomenon of unemployment. For the economy as a whole, unemployment due to over supply of labor is considered a burden rather than a bonus. Jobless people consume, not to create, social wealth as long as they remain unproductive.

China is the largest developing country in the world. But for its huge population and the almost unlimited supply of labor, China has long been hindered by insufficient supply of capital, raw materials and technology in its drive for industrialization and modernization over the last few decades. In this context, the coming of the "window of opportunity", as previously discussed, is seen by many people as an additional pressure

on economic development and an extraordinary challenge to the government. In 2001, China's total labor force stood at 730 million, with 67.2% classified as rural and 32.8% as urban. In urban areas, the official unemployment rate was 3.6% and 6.8 million people were registered as jobless. On top of that, there were 5.2 million workers laid off temporarily by employers. According to some experts, therefore, the real urban unemployment rate must be 7% or even higher. In rural areas, it is estimated that the total surplus labor lies in the range between 150-200 million. In other word, about 30-40% of total rural labor force are considered underemployed, if not unemployed (Institute of Labor Science, 2003).

In the next few years, it is believed that the difficult situation on labor market can hardly be improved because of a number of reasons. On the supply side, the first challenge comes from the growing number of new labor market entrants, 20-25 million annually by 2010 according to projections. Another factor is the high level of labor participation. At 77.03%, China's labor participation rate is considered one of the highest in the world, particularly that of women. On the demand side, the economic restructuring and rationalization in recent years have an unwanted side-effect on labor market by cutting down nearly 40 million jobs, mainly in the loss-making state owned enterprises. One third of the unemployed have difficulty in finding new jobs, consisting largely of women, older workers and people of poor education or with little skills. At the same time, technological advance makes it increasingly possible to raise productivity and profit with fewer workers. It is estimated that, in 20 years since the 1980s, the employment elasticity has dropped by two third from 0.32 to 0.11. That means, although the economy grows at a high rate, the number of new jobs it creates is actually declining. For example, as many as 9.4 million new jobs were created in 2001, but it is only half of that were created annually on average in the 1980s.

For the country as a whole, it seems hard for the result of age structural transitions to be translated into the "demographic bonus" quickly in the current circumstances. However, the situation may look different from one province to another. For example, Guangdong has a younger population compared with Heilongjiang, as shown in Table 2, but has a higher per capita GDP. Although being the second largest province in China, Guangdong has little worry about unemployment. On the contrary, it attracts millions of young people every year from neighboring provinces to work in its shriving economy. In comparison, Heilongjiang has been struggling with massive unemployment for years after the rationalization of state owned enterprises, the backbone of local economy. The current higher proportion of people in working ages makes the situation probably even worse. It indicates that economic growth is always conditioned by many factors, and we cannot take the "demographic bonus" for granted.

To meet the mounting challenge on labor market, the government has attached top importance to job creation. A series of policies have been introduced to promote employment in recent years. For example, many preferential policies have been adopted to attract more foreign investment, in order to make full use of China's No. 1

competitive advantage: abundant and cheap labor. China is now one of the major capital importers in the world, with FDI reaching as high as US$ 50 billion each year. It is frequent to hear people predicting that China is going to become "factory of the world" by flooding the world market with cheap and quality products. At home, priority is given to the promotion of labor-intensive industries, such as manufacturing industry and the service industries, the promotion of the private sector and small and medium-sized enterprises (SMEs), and the promotion of urbanization. A number of active labor market policies have also been introduced to promote job matching, training and certification.
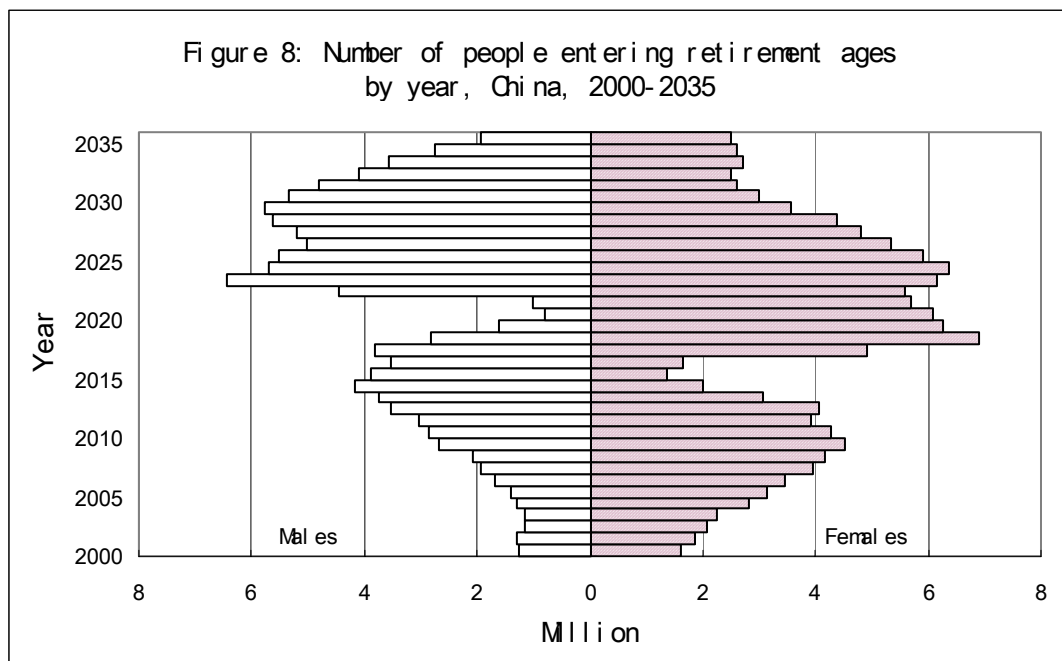
7. The implication of age structural transitions to old age support:

As discussed above, China is going to face an unprecedented challenge of old age support, as hundreds of millions of baby-boomers start to enter retirement ages in the next 10 to 20 years from now. When the majority of baby boomers retire by 2030, China's total elderly population will reach 225 million, and their proportion in total population rises to 15%. By that time, this means, almost one in every six persons in China will be classified as old. During the same period, the aged dependency ratio, an indicator regularly used to examine the possible burden the elderly pose on the economically active population, is likely to fall from the current 9:1 to 4:1. In other word, for every elderly person, the number of potential supporters will drop by half from nine to only four.

Also worth noting is the fact that the number of people entering old ages fluctuates drastically from year to year. Figure 8 gives the number of people expected to retire each year from 2000 to 2035. In China, the formal cut-off age for retirement is 60 for males and 55 for females, resulting in a 5-year difference. Before 2005, about 37 million people retire each year on average. When the first wave of male baby boomers start to retire after 2010, their female counterparts have already left the labor force 5 years earlier. During this period, the number of the newly retired rises to 63 million each year on average and won't stop growing before reaching 72 million in 2012. Around 2016 there will be a drop in numbers to 52 million, because of the coming-in of the smaller female cohorts born during the famine period 1959-1962. The impact of the smaller male cohorts can only be slightly felt around 2021, being off-set by the large female cohorts from the second wave baby boom. The high tide of retirement comes during the 2020s, when a total of 997 million people exit the labor force gradually. The year of 2023 will witness the largest ever cohort, as many as 125 million, retired in a single year. The number of new retirees will start to decline only after 2030, as the majority of baby boomers are supposed to have stopped working. In reality, not all people cease to work at the official cutting-off age of retirement designed primarily for urban dwellers. As found by studies in most developing countries, many rural elderly in China continue to be engaged in various labor activities on and off the farm after 60, either because of lack of a formal retirement program in the countryside or because of

the need to support household economy.

To target the special needs of the elderly people, old age support may be divided into three broad categories: economic (financial and material), physical and emotional. Old-age support may also be divided by the nature of a provider into two systems: formal and informal. As far as economic support is concerned, different social welfare policies and old-age pension schemes apply to different regions in China. The place of residence, occupation and the nature of employers' ownership can be decisive factors

Figure 8: Number of people entering retirement ages by year, China, 2000-2035

for people claiming welfare benefits.

Source: Reconstructed from Sun, 1994.

In urban areas, an old age pension scheme was introduced as part of the worker welfare system as early as the 1950s, but it covers only public servants and employees of state-owned enterprises. The old scheme is now under pressure to reform for a number of reasons. On the demand side, the number of entitled people is growing. From 1986 to 1998, for example, the retired workers increased from 17.2 million to 34.7 million, annual per head pension payment from 1,001 Yuan to 5,972 Yuan, and total pension payment from 17.2 billion Yuan to 207.3 billion Yuan. On the supply side, the pay-as-you-go based pension fund is shrinking. Pension funds in some regions ran out of money quickly, leaving the retired with no pay for months. Local governments have to use bank loans to make up the deficit. In 1997 the State Council issued a decree to establish a unified pension system for the entire urban labor force. The new system consists of a basic pension fund and a superanuation system based on personal account. The program was extended to the non-public sector in 1999. Given the extreme complexity of the system and the huge number of people involved, the transition from the old system to the new one will take years to complete.

Unlike in the cities, a formal old age pension scheme has never been introduced in rural areas. In fact, the government expects or requires that the support of the aged be shouldered by their families and supplemented by community assistance. Most elderly people are supported by family members in the form of shared housing, food and other necessities through co-residence. A pilot old age insurance program was introduced in rural areas in 1991. As many as 50 million peasants had joined the program in mid-1990s, pooling a total fund of 5 billion Yuan (Ministry of Civil Affairs, 1995). In foreseeable future, China's economy cannot develop fast enough to afford a Western-style social security system to be established in rural areas when baby boomers begin to enter retirement ages. The majority of them have to rely on other family members for old age support. In this context, discussions on old age support, the economic support in particular, in rural areas should focus primarily on measures to maintain and enhance the traditional family support system, rather than to introduce a formal pension program. However, local governments should make efforts to keep the current community welfare system functioning in looking after those unfortunate elderly who might fall out of the family safety net for one reason or other.

7. Concluding remarks

In the years to come, age structural transitions in China will be influenced continuously by people born during the baby boom period 1950s-1970s. They are unique in China's history, not only because of their sheer size but also because of their dramatic experience at almost every stage of their life cycle under the government's numerous social experiment efforts. More importantly in the demographic sense, they are the first generation whose fertility behavior has been strongly influenced by the government's birth control policies. Therefore, the huge baby boom generation is not only preceded but also followed by smaller generations, resulting in a quite irregular shape of China's population pyramid.

Although age structural transitions are more or less an indirect result of a country's social and economic development, it obviously has a series of direct implications. Having studied in very crowded schools, baby boomers in China now are competing in a very crowded labor market. In the next 10 to 20 years, they are going to face a financially still uncertain old age when a smaller generation becomes their providers. To make full use of the "widow of opportunity", the government should strive for an even faster growth of national economy with the potential of the largest working population in history, in order to meet the targets of industrialization and modernization. On the other hand, the government should take advantage of a still relatively young labor force to accelerate the reform of the public pension system in cities. In rural areas, priority should be given to consolidating the family-based old age support system in the short run, and introduce a formal pension system in the long run.

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