Demographic transition, demographic dividend, and Lewis turning point in China

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The disagreements on changed stages of demographic transition and the role of a demographic dividend in a dual economy development process often lead to wide debates among scholars about China's development stages. This paper tries to reveal the nexus between demographic transition and dual economy development: the common starting point, close-related processes, and identical characteristics of stages. Based on the empirical evidence of population dynamics, the paper supports the judgment of diminishing demographic dividends and an imminent Lewis turning point in China. The paper also argues that keeping a sustainable and steady economic growth, and becoming a high-income country as early as possible is the key and only way to close the 'aging before affluence' gap. Accordingly, the paper concludes by proposing measures to exploit the potential of the first demographic dividend, creating conditions for a second demographic dividend, and tapping new sources of economic growth.

Keywords: demographic transition; demographic Dividend; Lewis turning point; aging before affluence

1. Introduction

One of the hot topics that inspire debates among scholars, policy researchers, and even policy-makers is whether Chinese economic growth is losing its source and momentum from demographic dividends. Another related topic is whether China reaches its Lewis turning point – namely, labor supply is no longer unlimited. In a research paper, Cai and Wang (2005) estimate that the decline in the population dependence ratio, as a proxy for demographic dividend, contributed 26.8% to per capita GDP growth during 1982 to 2000, and warns that such a demographic dividend will disappear after 2013 when dependence ratio stops decreasing and begins increasing. By examining changes in the trend of China's age structure and the demand supply of the labor market, widespread rural labor shortages, wage increase of ordinary workers, Cai (2008a, 2008b) asserts that the Lewis turning point has indeed come, and points out its policy implications in terms of growth pattern transformation, income distribution trends, labor market institutional construction, and human capital accumulation.

While some researchers and even some policy documents support and cite the conclusion about the arrival of the Lewis turning point, others strongly disagree. In previous replies, Cai (2008a) tried to provide a wide range of evidence to defend his arguments. It turns out that people come out with conflicting opinions about economic reality, and explain the same phenomenon in different ways. Many still firmly hold to the conventional wisdom that there is a massive and increasing working age population and thus endless

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surplus labor force in rural areas, and that this is an unchangeable characteristic of China. Propositions which assert the possibility of labor shortage or disappearance of the surplus labor force in agriculture – namely that the Lewis turning point is arriving – are not widely agreed.[1] Specifically, all skeptical and critical comments on the judgment about an ongoing Lewis turning point, which results from a static understanding of population and labor force in China, are generally puzzled by the Chinese statistics. In what follows, I unveil some aspects of such statistical puzzles.

First, given that the official survey on utilization of agricultural workforce is unable to reflect the fast-changing reality of agricultural production, some scholars are unaware of the changed situation, while others who have tried to understand the statistics are actually trapped in 'the tyranny of numbers' as was Young (1994) when he tried to challenge the 'East Asian miracle'. Either case makes any endeavor of econometric analysis hostage to the data. The point is that economic reform in China has been too fast for the statistical system to catch up (Ravallion and Chen 1999). One of the many examples that cause confusion concerns the accurate numbers of agricultural workforce actually used. In 2008, the reported total labor force engaged in agriculture was 307 million, accounting for 39.6% of the country's total employment, and the figure provided by 2008 Agricultural Census was even higher. However, the actual input of labor in agricultural production, calculated based on agricultural costs survey data, turns out to be much less than any published aggregated figures (Cai and Wang 2008). Comprehensively considering the changing trend of working age population in rural area, the updated situation of labor migration from rural to urban sectors, and the extent to which agriculture is mechanized, one must conclude that the actually used workforce in agricultural production is much less than what official statistical publications declare. Therefore, the declaration that there is large amount of surplus labor to be shifted from agriculture (Lau 2010a) or the conclusion that the marginal productivity of labor in agriculture is still very low (Minami and Ma 2009), which are both based on the aggregated dataset, tend to overestimate the degree of labor surplus in agriculture and conclude that the Lewis turning point has not come to China.

Second, scholars have difficulties in interpreting statistics on labor market and rural and urban employment, and thus they often elicit conclusions that deviate from reality. As the result of sectoral changes and increasing diversification of ownership, especially after the labor market shock in the late 1990s, multifaceted sectors have appeared to absorb labor into urban areas, contrary to the pre-reform period when state and collective sectors dominated employment absorption. Among those sectors of employment, large-scale informal employment, as the byproduct of reemployment of the laid-off and of diversity of employment, is new to China. Meanwhile, massive numbers of rural laborers have transformed their jobs from agricultural to non-agricultural sectors, amounting to 240 million, of which 145 million migrated into cities. In routine statistics, neither informal employment of urban residents nor employment of migrant workers in urban sectors has been authoritatively reported, except for estimated figures of migrant workers based on sampling surveys and aggregated estimate of informally employed urban residents under certain assumptions (Cai 2004). We can view the difference between the number of total employment based on the unit reporting system and the number of employment based on the household survey as a proxy for urban informal employment, which amounts to 95.1 million and accounts for 31.5% of total urban employment in 2008. It is, however, helpless if one wants to do any statistical analysis on structural characteristics of the total employment, because of lack of disaggregated data on it. Moreover, the statistical authority has so far not promulgated an alternative surveyed unemployment rate data series to the discredited registered unemployment rate, and that leads scholars to do various guesstimates on the unemployment rate.

Based on incomplete employment data and unfounded guesstimates, Chinese and international scholars often educed conclusions such as zero growth of employment and a high and increasing unemployment rate (Ru, Lu, and Li 2008, 22; Rawski 2001; Solinger 2001) and doubt the authenticity of the widespread labor shortage.

Third, there is no officially published systematic data and up to date information on the status of demographic change and population dynamics. While various rounds of national population censuses provide information on population changes, no authoritative projections of population change, including predictions of magnitude and the age structure of the population, have been periodically publicized, due to lack of consensus on some important parameters such as the total fertility rate (TFR).[2] The public and academia therefore do not have updated information about the population developments trends and many conceive that the peak of population growth will be reached in or after 2040 and then the total population in China will as many as 1.6 billion (e.g. Lau 2010b). More specifically, most scholars ignore the fact that the growth of China's working age population has been slowing and thus the demographic foundation of unlimited labor supply has been shrinking, and therefore they are unwilling to accept the assertion of an ongoing Lewis turning point associated with a diminishing demographic dividend.

It is obvious that an undistorted understanding of status and trends of demographic transition will help scholars and policy researchers better understand the state of labor market and will serve as a foundation for policy decisions on how China can sustain its economic growth. The following sections of the paper will argue that the demographic transition and dual economy development have a common starting point, related and similar characteristics during successive development stages. To a large extent, they share overlapping processes. Consequently, the demographic dividend period brought about by the population change is one stage in the dual economy development. Accordingly, the theoretical and empirical work and reasoning about a diminishing demographic dividend and incoming Lewis turning point kill two birds with one stone. The rest of the paper is organized as follows. Section 2 reveals a stylized fact about relationship between demographic transition and dual economy development based on international experiences. Section 3 depicts the China's process of demographic transition and its impact on economic growth. Section 4 tries to answer the question of how the 'aging before affluence' gap can be narrowed. Section 5 concludes by drawing policy implications of the issues discussed in the paper.

2.   Stages of demographic transition and development of dual economy

The theory of dual economy coined by Lewis (1958) divides a typical developing economy into two sectors: the agricultural and modern sectors. Because labor force is superfluous relative to capital and land in agriculture, its marginal productivity in the sector is very low, even as low as zero or below. As the modern sector expands surplus labor in agriculture is transferred to modern sector without substantial rise of wages, and the whole process is typically called the development of dual economy. Such a process continues until it reaches a point at which the growth of labor demand succeeds growth of labor supply and further labor transfer requires increase in unskilled workers' wage rate. That point is generally called Lewis turning point. In spite of its ups and downs in economics history (Ranis 2004), Lewis theory of dual economy has remained as a key theoretical model in development economics.

However, the demographic transition theory had been formally established before Lewis's prominent paper.[3] Corresponding to pre- and post-industrialization periods, demographic transition is categorized into three stages, characterized (1) high birth rate,

high mortality and low natural growth rate of population, (2) high birth rate, low mortality and high natural growth rate of population, and (3) low birth rate, low mortality and low natural growth rate of population. Although whether Lewis was aware of the literatures on demography is unknown, Lewis did provide assumptions similar to those used in demographics. In the definition of agriculture the important sector in a dual economy, he explains: 'population is vast relative to capital and natural resources, so that . . . marginal product of labor is negligible or even zero', therefore, 'there exists an unlimited supply of labor'. The implicit assumption of this statement is that a typical dual economy characterized by unlimited supply of labor is at the second stage of demographic transition – that is, natural growth rate of population is high as the result of declined mortality and inertial high birth rate. Since agriculture is primary sector in the sectoral chain, it is the place where the abundant population and surplus labor force roost.

The key of understanding the logical and empirical relationship between demographic transition and development of dual economy is to explore how demographic dividend is engendered and obtained. In early literature on demography and economics, the relationship between population and economic development was mostly explored by studying the relationship between the economic growth rate and the population growth rate, while the discussion on demographic transition went no further beyond fertility rate, birth rate, mortality, and population quantity. Besides, mainstream of growth theory, while incorporating population into endogenous growth, usually neglects characteristics of demographic transition of dual economy. After long negligence of economic development and structural characteristics of population, particularly the relation between population age structure and labor supply, as all developed countries and many newly industrialized economies successively completed their demographic transition process, demographers became conscious of population aging and its consequences. Economists further unveil the change in working age population going with fertility decline and its effect on sources of economic growth (Williamson 1997). That is, in the interval between a sooner decline of death rate and later decline of birth rate, natural growth rate of population is usually at its fast rise, youth dependence ratio is also increasing. After a certain period of time, as fertility decreases and the baby boomers grow up, the proportion of working age population enhances accordingly. The further decline in fertility as a result of economic and social developments causes slowdown of natural growth rate of population, and the structural consequence of such a dynamics is population aging. In short, following a reversed U shape pattern – namely, natural growth rate of population first increases and then declines after a turning point, with an interval of about one generation, growth rate of working age population presents a similar pattern of changes.

During the period in which population age structure is most productive, adequate supply of labor and high savings rate afford an extra source of economic growth and thus form demographic dividend. Consequently, once demographic transition exceeds this stage – namely, population age structure becomes less and less productive, because of the rapid aging, such conventionally defined demographic dividend gradually disappears. Since the stages in demographic transition can be sufficiently characterized by changes in TFR, one can theoretically expect the following relation between demographic transition and economic growth (Figure 1): the stage of high TFR coincides with steady state of low growth rate; as TFR falls, a more productive population age structure emerges, and demographic dividend promotes higher economic growth rate; when TFR further drops while and population ages, economic growth rate declines to lower steady state. Correspondingly, the specific stage that TFR declines but and population age structure is dominant by productive workers forms a demographic window of opportunity.
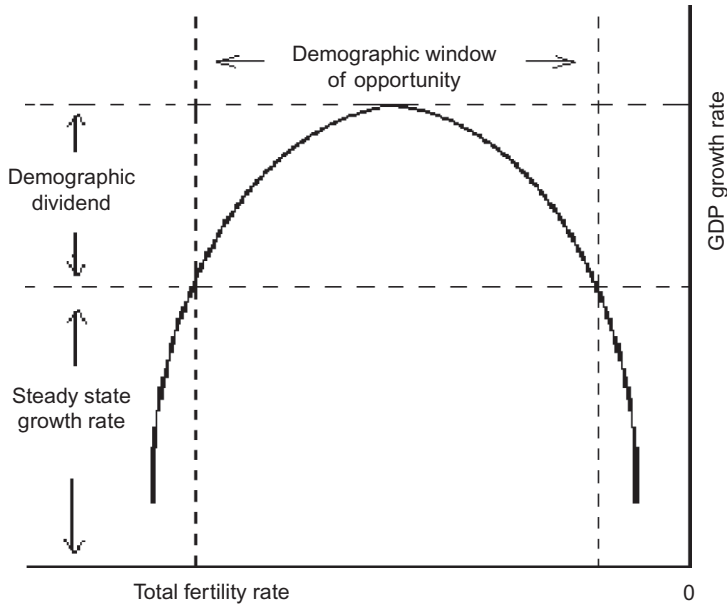
Figure 1.   Relationship between fertility and economic growth.

It is worth noting that factors impacting the performance of economic growth are multifold, not just of population. This is also true in explaining both the steady state of growth rate of low-income economies, known for poverty trap, and the steady state of growth rate of high-income economies struggling in technological innovation frontier. For example, in the empirical works of defending neoclassical growth theory, economists have found more than one hundred explanatory variables, which are statistically significant in unveiling determinants of growth performances, but none is sufficient and exclusive (Sala-i-Martin 1997). For simplicity, we also put aside the retroaction effect of economic growth on demographic transition[4] and focus on the straightforward relationship between fertility and economic growth. Under the assumption made above, this fertility-growth nexus can be deduced from the theory of demographic dividend and confirmed empirically.

The panel data from World Development Indicators enable us to provide a descriptive statistics between annual GDP growth rates and TFR levels at the country level since 1960. In this dataset annual GDP growth rates ranged from -51% to 106%. To avoid the complexity in dealing with outliers, we focus on investigating growth rates between 0% and 10%, to better reflect normal range of annual GDP growth rate. Our theoretical model predicts that the relationship between economic growth rate and fertility is not a simple linear one but follows a complex nonlinear relationship. That is, as TFR declines, the economic growth rate increases first and then declines. In Figure 2, according to the function relations between GDP growth rate and TFR and square term of TFR, we present the fitted value of annual growth rate of GDP with 95% confidence interval.

Figure 2 intuitively presents a reversed U shape pattern of GDP growth rate against decline in TFR – countries at the lower stage of demographic transition characterized by high TFR usually suffer poor economic performance; as their TFR levels fall, economic growth speeds up; after a certain point, as TFR further declines and demographic transition enters later stage characterized by very low TFR, economic growth tends to slow down.
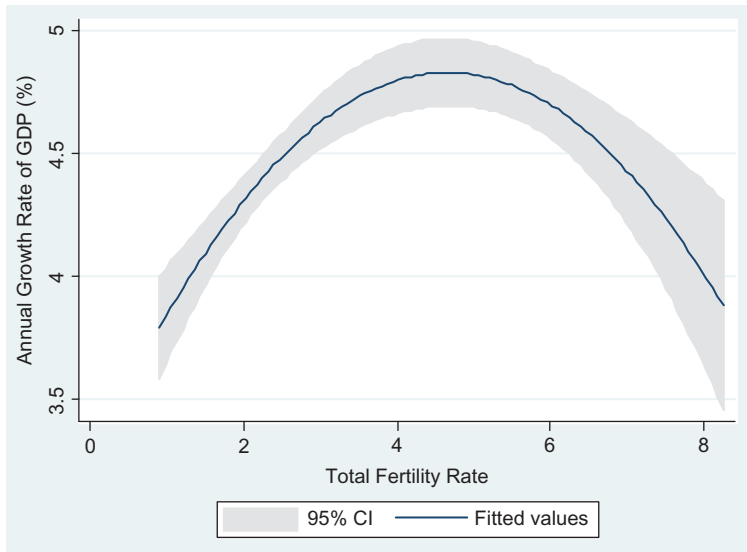
Figure 2.   Empirical relationships between TFR and GDP growth.
Source: Calculation based on dataset of *World Development Indicators.*

Such a simplified empirical curve is consistent with the theoretical prediction described previously.

To further examine the statistical significance of the nonlinear relationship between TFR and economic growth, we regress GDP growth rate on TFR and squared term of TFR (Table 1). The regression results show the reverse U shape relation between GDP growth and TFR by revealing the significantly positive sign of TFR coefficient and negative sign of squared term of TFR. Once we can establish the relationship between fertility rate and economic growth from the perspectives of economic theory as well as international experiences, we can better understand the demographic transition studied in demography, and the relationship between population dividend and the Lewis turning point in economic development. Therefore, we can further analyze the occurrence and disappearances of population dividend in economic development to judge whether the Lewis turning point has arrived.

3.   The economic impacts of Chinese demographic transition

After the founding of the People's Republic of China in 1949, China's demographics transitioned into the second stage accompanied by economic development and improvement in people's living standard. With the exception of the abnormal years between late 1950s and

Table 1.   Regression results: the relation between TFR and growth.

	Coefficient	Standard error	*t* value	P >	*t*	
TFR	0.6852	0.1133	6.05	0.000
TFR square	−0.0736	0.0137	−5.38	0.000
Constant term	3.2359	0.1909	16.95	0.000
Observations		3380		

early 1960s, the second stage of transition manifested itself through significantly declining mortality rate while birth rate remained at a sustained high level. As a result, natural population growth rate was excessively high. Correspondingly, TFR had constantly remained as high as 6(%) until 1970s. However, unlike what many people had imagined, the decline of TFR was NOT the result of the one-child policy. As a matter of fact, the fastest decline of TFR had happened before the one-child policy was strictly implemented. TFR dropped by 3.5 percentage points, from 5.8 to 2.3 in the decade of 1970 to 1980. If we can assume the current TFR to be in the range of 1.6 to 1.8, TFR only declined 0.5 to 0.7 percentage point after 1980. This empirical fact confirms the consensus reached by economists and demographers on demographic transitions. That is, the three major sequential demographic transitions are primarily the result of economic growth and social development. In the period of demographic transition from second to third stage, working age population grows faster than dependent population; hence the proportion of working age population increases gradually. This releases the demographic dividend that upgrades economic growth rate to a level above the steady state.

Although China's population dependence ratio – namely, the ratio of dependent population aged 14 and younger and 65 and older to working age population aged 15 to 64, declined as early as in the middle of 1960s, the substantial increase of working age population and its share in total population, associated by dramatic fall of population dependence ratio, started in the mid 1970s (Figure 3). Such favorable age structure of the population has been translated into demographic dividend that spurred unprecedented performance of economic growth in the Open and Reform period. A series of publications (for example, Cai 2009; Cai and Wang 2005) explain the rationale, process, and empirical tests of the demographic dividend in the development of dual economy of China. In these studies the authors also reach the conclusion of the arrival of the Lewis turning point, and provide empirical tests and proofs of theories. In this paper we discuss demographic transition, demographic dividend, and Lewis turning point in one framework, we intend to explain the logical and historical relations among these three concepts, and to elaborate the challenges China faces in economic development.
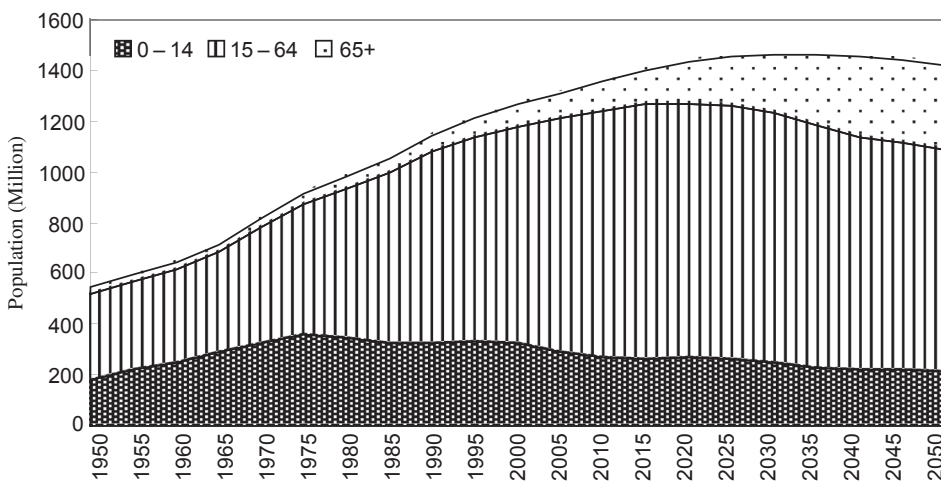

Figure 3.   Changing trends of population age structure.
Source: United Nations, 2009.

The forecast of China's population and its age composition by United Nations, shown in Figure 3, is based on the Fifth Census that was conducted in 2000, the 2005 1% Sample Census, and the official estimates of TFR and other variables. The forecast was the medium estimate and most recently updated in 2008. It is fairly consistent with those made by various Chinese institutions. According to this forecast, China's total population will reach its peak in 2030 and amount to 1.46 billion. Before then, the working age population aged 15 to 64 will reach its peak, 998 million, in 2015. Although these two forecasts on population peak can be obtained from public source at any time, it is obvious that they are unknown not only to the general public but also to a fair number of economists. However, familiarizing oneself with the changing trends of Chinese population is definitely required for scholars who are studying the future of Chinese economic development, especially for those who often voice their opinions and greatly influence the public.

Upon further examining the forecasted results in Figure 3, one can find that the growth rate of working age population was faster than that of total population in the period of 1970 to 2010, and then the trend will reverse – namely, the age structure of Chinese population will no longer evolve to be more productive. From the perspective of labor supply, since urban areas are the centers of development for non-agricultural industries, the employment created by China's fast economic development mostly took place among urban entities, and labor supply in urban areas more and more rely upon rural-to-urban migration.

According to another forecast, which takes into account the impacts of rural-to-urban migration (Hu 2009), by 2015, the amount of incremental working age population in urban areas will be less than that of reduced working age population in rural areas. This implies that without substantial enhancement of incentives that encourage rural-to-urban migration, the migrant workers will not fill up the gap vacated by rapid reduction of urban labor force. Before reaching this point, according to how we calculate urban residents, that is, after taking into account rural-to-urban labor migration, the reduction in rural working age population is approaching the increase in urban working age population year after year (the point where two populations equal to each other is when, China's working age population, in aggregate, stops increasing). The labor market has gradually responded to this situation, which has manifested itself through, on the one hand, nationwide labor shortage and on the other, annual wage increase of migrant workers. By definition, these are the characteristics of Lewis turning point.

4.   How to close the 'aging before affluence' gap?

The worldwide experiences show that economic growth and social development are major driving forces behind demographic transition, while population policy plays an external and relatively minor role. Very much like China, countries (or regions) such as Korea, Singapore, Thailand, and Taiwan, where no compulsory population control policy has been implemented, have seen their TFR decline, from a high level similar to China in 1950s to as low as below replacement level in 1990s. Even India, where economic growth and social development have not grown as fast, therefore demographic transition has been lagged relatively behind, has also followed a similar demographic path (Lin 2006). In spite of the unprecedented economic growth in the past 30 years, due to the fact that China set off its high economic growth in the 1980s, much later than the four Asian Tigers, China entered into the new stage of demographic transition at relatively low income per capita, which is characterized as 'aging before affluence'. In 2000, the proportion of ages 65 and over in total China's population was 6.8%, identical to the world average, whereas China's per

capita GNI was only 17.3% of the world average based on official exchange rate and 56.3% of the world average based on purchasing power parity. While one must admit that the strict implementation of one-child policy is an accelerator pushing down the fertility, the demographic transition, conclusively, is the result of economic growth and social development. The difference of income level between China and developed countries is therefore the root cause of the 'aging before affluence' gap.

Most developed countries are facing the challenges of population aging to sustainable economic growth and pension insurance scheme, and the efforts in confronting such challenges vary from country to country. However, overall, since developed countries are at a high-income level and technological innovation frontier, they have dealt the aging population crisis so far by sustaining economic growth with elevated productivity. Correspondingly, the key for China to tackle the challenges of shrinking working age population and expanding aging population is to sustain its fast economic growth. In other words, since demographic transition is an irreversible process and cannot be stopped even if one-child policy is modified, aging population trend will continue. The already formed 'aging before affluence' gap can only be narrowed and eventually closed through sustained economic growth.

As the Chinese economy ascends itself in the world's economic pecking order and is expected to surpass Japan and become the second largest economy in 2010, given its low growth rate of population, per capita GDP level of China will rapidly step up. One long-term forecast on China's economic size and per capita GDP conducted by Japanese Center for Economic Research (JCER 2007) predicts that based on PPP and the constant US dollar of 2000, China's aggregate GDP will reach $17.3 trillion in 2020, $25.2 trillion in 2030, and $30.4 trillion in 2040. The projected per capita GDP in the three reference years are $12 thousand, $18 thousand, and $22 thousand, respectively. An even more optimistic forecast by Fogel (2007) expects that China's total GDP will reach $123.7 trillion in 2040, and based on the projected population of 1.46 billion, per capita GDP will be as high as $85 thousand then. It is worth pointing out that these two forecasts are widely different in terms of methodology and data sources. In particular, the calculations involving purchasing power parity are inconsistent with official Chinese entities and scholars. In fact, the gigantic gap between the two forecasts highlighted the limitations of such projections.

Nonetheless, the afore-mentioned forecasts reveal the fact that beginning from the second decade of twenty-first century, as the second largest economy of the world, China will speed up its transformation from a middle-income country to a high-income one. Suppose China can maintain the same pace of or slightly lower than the growth rates of both total and per capita GDP realized in the past 30 years, a significant convergence of wealth level between China and developed countries will be realized. In this regard, the predictions made by these economists reflect a correct direction and futuristic vision. Therefore, under the assumption of unchanged demographic transition, the gap between economic development level and population aging will eventually be closed.

In Figure 4, we compare China's age structure of population with developing countries in year 2000 and 2010 to show the characteristic of 'aging before affluence', whereas we compare China's age structure of population with more developed countries in year 2020 and 2030 to show the pronounced narrowing of 'aging before affluence' gap. This demonstrates that the fundamental solutions in dealing with population aging in the post Lewis turning point eras are threefold: tap the potential of remaining demographic dividend, create new demographic dividend, and find new sources sustaining long-run economic growth.
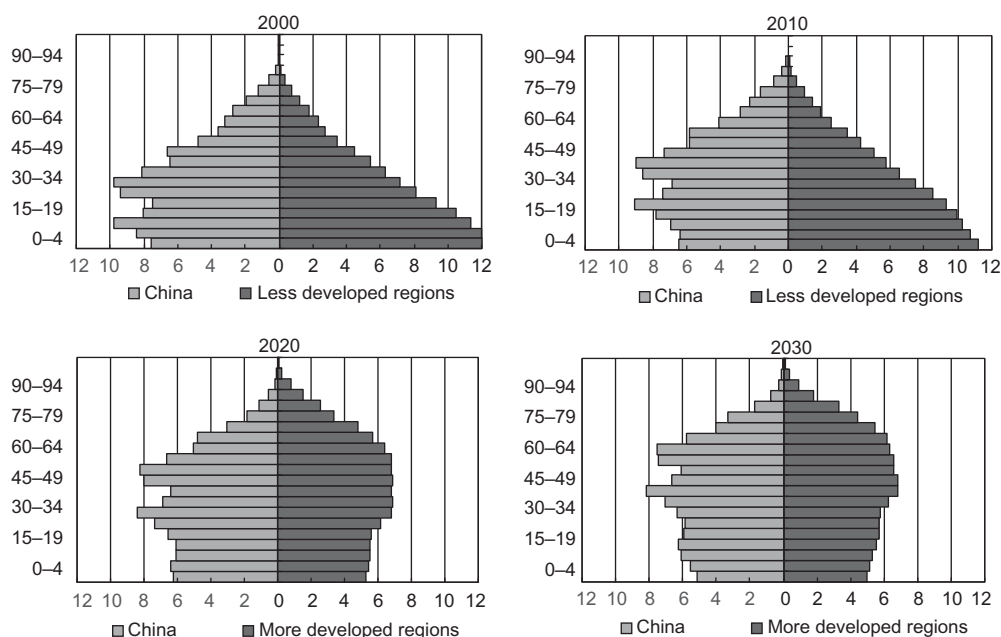
Figure 4.   Narrowing the 'aging before affluence' gap by economic catching up.
Source: United Nations, 2009.

5.   Conclusion and policy implications

The analysis on China's demographic transition and its economic impacts convince us of the close relationship between demographic transition and economic development, and thus the conclusion of diminishing demographic dividend and ongoing Lewis turning point is pursuant with both economic theory and empirical evidence. Even the debates about these conclusions, to some extent, clue to that the arrival of Lewis turning point, discussed in this article, has important policy implications.

The arrival of Lewis turning point is vitally important for a developing economy, because only when it does pass through this point that the marginal productivity of labor in traditional economic sectors begins to converge with that of modern economic sectors. When eventually the productivity gap among sectors disappears, the economy as a whole reaches the point of commercialization and the structural characteristics of dual economy disappear. Therefore, the conclusion of the arrival of Lewis turning point should not raise any concerns. In contrast, being cognizant of this turning point has not only theoretical meaning but also practical significance. That is, in order to find long-lasting sources of growth to sustain and deepen economic development, correctly forecasting the arrival of Lewis turning point and recognizing new challenges and opportunities in this new development stage has important implications in regard to government's economic development policy, decision making among private enterprises, and labor behavior among individuals. In the following we examine the potential sources of China's sustained economic growth in post-Lewis turning point period from the short-term, medium-term and long-term perspective, based on experiences of other economies.

First, there still is potential of the existing demographic dividend to exploit in the short run. Let us first divide demographic dividend into two types: first demographic dividend

and second demographic dividend. While the first demographic dividend can be defined as the scenario where labor supply is abundant and savings rate is high, thanks to the increasing magnitude and proportion of working age population, the second demographic dividend can be associated with new motivations of savings and new supply of human resources, resulted from an aging population. Based on this division of demographic dividends, the first dividend has yet to be fully explored. The exploitation of first demographic dividend has been mainly manifested in labor transformation from agricultural to secondary and tertiary sectors. In 2009, migrant workers who lived in cities for 6 months or longer reached more than 150 million, contributing significantly to the urbanization rate, which has reached 46% in the same year, after taking into account these migrant workers. While according to the definition, part of the longer-stayed rural-to-urban migrants are counted as urbanites, since they do not legitimately have urban *hukou* or urban resident status, from the perspectives of a stable source of labor supply, newly created demand for consumption and urban infrastructure, and contributors to the social welfare system, these migrants have not fully made their contributions to the first demographic dividend. In 2007, China's urbanization rate was 45% while the population with urban *hukou* was only 33%, a 12% gap between the nominal and actual urbanization rate. This suggests that further *hukou* reform and equitable provision of public services can exploit the other half of the first demographic dividend on a continuous basis (Cai 2010).

Second, there is vast potential of exploring the second demographic dividend. An aging population structure can also possess advantages, namely second demographic dividend, as long as necessary institutional conditions are met (Cai 2009). As one of the important causes for population aging, the increase of life expectancy, people live longer and healthier, is the foundation to generate the second demographic dividend. This kind of demographic dividend includes three major sources. A first source comes from the demand of old-age supports and supply of pension institutions. As long as there is fully funded pension scheme instead of pay-as-you-go or family support system, the workforce will have larger incentive to accumulate assets for retirement purposes, and then high savings rate can be maintained by investing in capital market and capital appreciation. A second source comes from the expansion of education resources. As the quantity of youth population reduces and its proportion in total population declines, the capacity of working age population supporting school-age population improves, relatively speaking, which is a window of opportunity for extending education and training and hence accumulating human capital. A third source comes from the expansion of labor force participation. Extension of retirement age is a major measure to expand workforce and alleviate the burden of supporting the senior population. In China, the major obstacle of extending retirement age is that the working elderly have relatively less human capital. Before this situation changes, extension of retirement age may put them in a vulnerable situation. Therefore, the key in exploiting such a dividend is to continuously expand education, especially that at the senior high school level, general and vocational education, and on-job-training. As conditions mature, we can then gradually extend the retirement age in order to provide abundant labor supply.

Third, transformation of economic growth model can provide a brand new source for economic growth. Assuming scarcity of labor and thus diminishing return to capital, the neoclassical theory of growth developed based on Western experiences argues that the only way to maintain sustained economic growth is to enhance the contributive share of total factor productivity (TFP) (Solow 1956). Based on this basic assumption, a few economists doubted the existence of East Asian miracle and, if there is, its sustainability (for example, Young 1992; Krugman 1994). In reality, thanks partially to the characteristics

of unlimited supply of labor and partially to adequate economic policies favorable for exploiting demographic dividend, the East Asian economies had long averted the crisis of diminishing return of capital. As some major economies passed through their Lewis turning points,[5] at the same time, the newly entered stage of demographic transition rendered their economic growth no longer dependent upon the traditional demographic dividend, those economies transformed their economic growth pattern from capital and labor driven to more TFP driven. Those experiences indicate that as first demographic dividend diminishes and Lewis turning point passes through, driving forces of the Chinese economic growth will be eventually transformed to a reliance on technological advancement and productivity enhancement. The assurance of changed stage of development requires us to speed up the pace of growth pattern transformation.

Notes

1. This existing paper does not intend to discuss the various views caused by different definitions of Lewis turning point. According to Lewis (1972) and Ranis and Fei (1961), Lewis turning point can be referred to as the period of time at which expansion of labor demand exceeds that of labor supply and, as a result, wage rate of ordinary workers starts to rise, while wage of agricultural sector is not yet determined by its marginal productivity of labor and the difference of marginal productivity of labor between agricultural and non-agricultural sectors remains. And the time when the wage rates in agricultural and non-agricultural sectors are both determined by their marginal productivity of labor and the gap in productivities disappears can be called the commercial point. Only at this time, dual economy ends.
2. The 5th National Population Census conducted in 2000 shows that China's TFR was 1.32, which is even lower than policy allowable level of 1.51. Many doubt such a result (e.g. Yu 2002). Since then the debates on what is the actual TFR of China have existed among scholars and policy researchers. Generally speaking, the government departments responsible for implementing the population control policy tend to believe in a higher TFR, whereas scholars believe in a lower TFR. In spite of the disagreement, the estimates mostly fall in the range of 1.6 to 1.8, which are all significantly lower than the replacement level of 2.1.
3. Whereas Thompson (1929) first identified the three stages of demographic transition and another scholar added two more later stages, they were both not considered as the father of the theory of demographic transition, because they did not provide standard theoretical explanation on the decline of fertility. The honor was later awarded to Notestein (1945). Please see Caldwell (1976) for a brief history of this field.
4. In an econometric study, Du (2004) found that population policy, per capita GDP and level of human capital are decisive factors driving down China's fertility and empirically identified the different effects of the three factors.
5. It is commonly believed that the Japanese economy in 1960 and Korean and Taiwan economies reached their Lewis turning point, respectively (for example, Minami 1968; Bai 1982).

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