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## China's age of abundance: When might it run out?



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### ABSTRACT

China is in a race between its slowing down economic growth and accelerating population aging. Based on macro data from national accounts and micro data from national household surveys, we apply the National Transfer Account framework to examine recent changes in income and consumption at both the aggregate and individual levels and project the effect of population aging on economic profiles. Our findings show that recent rapid economic growth has resulted in a sizable lifecycle surplus, with labor income far exceeding consumption. With expected increases in consumption, as shown in the historical experience of Taiwan, and with accelerating population aging, however, this surplus is expected to be erased before 2035. China's three-decade long economic boom has led to an age of abundance, but that era will most likely to end in front of the eyes of the current young generation.

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### Introduction

China is in a race with itself. Economically, three decades of virtually uninterrupted hyper-growth has propelled one-fifth of humanity into the ranks of middle-income countries. In 2012, China registered its first annual economic growth rate (7.8%) that is substantially below past levels in a decade. The growth rate for 2013 was about the same as for 2012. Though a close to 8 percent annual growth rate is still among the world's fastest, it is about a third below the average for the preceding decade for China itself, and may well mark the beginning of the end of China's hyper-growth era. Demographically, China's population is aging at a historically rapid pace – the size of population aged 65 and above in China reached 131 million in 2013, more than the entire population of Japan, and is expected to add another 100 million by 2030. As China stands among middle-income countries, its population now expect corresponding standards of living, such as safe and quality food, clean air, adequate healthcare and pension support. How ready is China in this race between its economy and demography?

Rapid, unprecedented, and unstoppable population aging in the largest population and the second largest economy in the world no doubt has numerous profound implications for China, and for the

rest of the world (Eggleston et al., 2013; Wang, 2012). The substantial drop in economic growth rate can be traced to numerous factors, both domestic and international. But it may not be a mere coincidence that it occurred when China's per capita income level is approaching the turning point suggested by analysis of historical data (Eichengreen et al., 2012, 2013) as well as by empirical studies of the world's economic history (e.g. Barro, 1997), and it occurred in the same year when China exhausted its demographic dividend (Wang and Mason, 2008). It also occurred in the same year as China reported a decline of labor force population (ages 15–59) by 3.45 million in 2012, a trend that is expected to continue at least until 2030 according to China's National Bureau of Statistics.

China is thus likely caught in the juxtaposition of a short-term and temporary excess in public and private wealth due to its rapid economic expansion and a favorable demographic condition, and a long-term, likely permanent, challenge to confront its population aging.

In this paper, we examine changes in income, consumption, and savings at both the aggregate and individual levels in China, and discuss their implications in the context of China's shifts in population age structure, especially rapid population aging. We use the National Transfer Account (NTA) framework to organize our examination. This paper is divided into six sections. In the "Analytical approach and data sources" section below, we introduce our analytical methods and data used. In section "Economic growth and China's age of abundance", we use macro data from the system of national accounts to offer a broad and descriptive

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contour of recent changes in income, consumption, and savings at the aggregate level in China. In section “Lifecycle Patterns in income and consumption”, we examine individual labor income and consumption patterns in recent years, as a way to anticipate further changes. In Section “Population aging and economic change: When might the abundance end?”, we examine the effect of population aging on lifecycle surplus using historical changes in income and consumption in Taiwan as a reference. In the last section, relying on results we present in the first five sections of the paper, we discuss the broad implications of China’s dual changes in economy and demography.

### Analytical approach and data sources

We employ the analytical approach of National Transfer Account (NTA) to understand and appreciate changes in China’s economy and the effects of population aging on economic profiles. The NTA approach captures a fundamental feature of all societies: the economic lifecycle (Chen et al., 2012; Lee and Mason, 2011; Li et al., 2009). Economic lifecycle refers to patterns of consumption and income across age that lead to a mismatch between material needs and the ability to satisfy those needs through one’s own labor. In all contemporary societies, the young and the old, on average, consume more than they produce through their labor, leading to what is called as a deficit. Working-age adults, in contrast, consume less than their labor income, hence generating a surplus. An individual’s economic lifecycle, in other words, is characterized by the stage of deficit, surplus, and deficit again.

The lifecycle deficit generated by the mismatch between consumption and labor income can only be financed through three sources: intergenerational transfers, asset income, or dis-savings.<sup>1</sup> The age-specific economic flows are expressed as the following identity:

$$C(x) - Y^l(x) = \tau^+(x) - \tau^-(x) + Y^A(x) - S(x) \quad (1)$$

The left-hand-side represents lifecycle deficit (or lifecycle surplus if the value is negative), which is the difference between consumption  $C(x)$  and labor income  $Y^l(x)$  at age  $x$ .<sup>2</sup> This deficit or surplus should equal to the sum of the items in the right-hand side of the equation, which includes three components: net transfers  $\tau^+(x) - \tau^-(x)$ , asset income  $Y^A(x)$ , and savings  $S(x)$ . Combined, the items on the right-hand of the equation are labeled as “lifecycle age reallocations.”

Except for labor income, the other components in the equation above can be distinguished by public and private sector. For instance, total consumption includes public and private consumption, namely, government and household consumption. The identity not only holds for per capita values at each age as Eq. (1); if we sum up the equations over age, the identity also holds for national aggregates as shown in Eq. (2) below. At the aggregate level, the size of economic lifecycle deficit or surplus is also affected by population age structure, in addition to the difference between labor income and consumption levels at the individual level. In young populations, the aggregate economic lifecycle is dominated by the large lifecycle deficit of the young. Over the course of the demographic transition, with the rapid expansion of elderly people, the lifecycle deficit of the older population becomes increasingly important.

$$C - Y^l = \tau + Y^A - S \quad (2)$$

<sup>1</sup> When individuals accumulate pension funds or personal saving during their working years and rely on asset income and/or dissaving of those assets during their retirement years, they are relying on asset-based reallocations.

<sup>2</sup> Consumption by age is an average across all individuals of a given age. The same definition also applies to other measures.

To calculate lifecycle deficit or surplus and lifecycle age reallocations, which rely on constructing measures of consumption, labor income, transfers, asset income, and savings at the national or aggregate level, we use officially released data in the forms of System of National Accounts (SNA) and government financial statistics (United Nations, 2013). These available aggregate values are broadly consistent with those required in the analysis using the National Transfer Account approach. However, some key economic aggregates in NTA, such as consumption, labor income and capital income, differ slightly from their SNA counterparts because of the treatment of taxes on products and production (or called indirect taxes less subsidies) (United Nations, 2013). More specifically, consumption, labor income and capital income are measured using pre-tax prices in the NTA, while they are measured using market prices in SNA. We make adjustment based on the estimated proportions of indirect taxes in our work.<sup>3</sup>

To examine changes in the aggregate measures described above in China, we select three years, 2002, 2007, and 2009. For the first two time points, survey based labor income and consumption data are available, and for 2009, it is the latest year that China has made its system of national accounts public.

To complement the analysis at the aggregate level, we also analyze changes in labor income and consumption across the lifecycle at the individual level, using survey data. Among the limited sources of individual level income and consumption data, we use China Household Income Project (CHIP) surveys. The survey is designed as repeated cross-sectional household survey, covering 22 out of 31 provinces in China, and with a history dating back to 1988 and continued through 2007 (Li et al., 2008). Previous work on lifecycle income and consumption in China utilized data up to 2002 (Chen et al., 2012; Li et al., 2009). In this paper, we use the recently available data from the 2007 survey to examine changes between 2002 and 2007. To make comparisons consistent, we applied the same methods in creating both the 2007 and 2002 profiles, with results adjusted to 2002 currency.

Finally, to examine the dual roles of economic change and population aging in China’s economic prospects, we project the magnitude of lifecycle deficit or surplus by combining results of population projections and future changes in income and consumption, with assumptions made based on the well-studied experiences of Taiwan.

### Economic growth and China’s age of abundance

China has been basking under a period of economic abundance. Nominal GDP quadrupled between 2002 and 2011, up from 12.03 trillion RMB to 47.29 trillion RMB.<sup>4</sup> Compared with the BRIC counterparts and middle-income countries in general, China’s economic performance has clearly stood out: its average annual growth rate of GDP attained 10.6%, the only country with a double-digit growth rate in the decade. In contrast to China, India’s GDP has grown at an annual rate of 7.7%, while Brazil and Russia both have a rate lower than 5%.

In line with the expanding economic scale, GDP per capita in China has also seen a rapid increase. GDP per capita stood at 9398 RMB in 2002, and skyrocketed to 35,181 RMB in 2011. The growth rate in 2007 reached a record high in the past decade, approaching 15%. Though global financial crisis severely hit China’s

<sup>3</sup> We make adjustments in two steps. First, we allocate indirect taxes to labor, capital and consumption, according to the proportion of government tax on labor, capital and consumption. Second, we subtract the consumption share of indirect taxes from final consumption to determine pretax consumption in NTA, while NTA labor income and capital income are augmented to include part of indirect taxes.

<sup>4</sup> China’s GDP is 51.93 trillion for 2012. <http://finance.people.com.cn/GB/8215/237698/354488/index.html>.

**Table 1**  
Lifecycle deficit and age reallocation in 2002, 2007 and 2009 (Unit: trillion RMB).

	2002	2007	2009	Annual change 2002–2007 (%)	Annual change 2007–2009 (%)
Lifecycle deficit	–1.79	–3.41	–2.96	13.8	–6.8
Consumption	4.79	7.02	9.78	7.9	18.0
Public consumption	1.43	2.91	3.62	15.3	11.5
Education	0.26	0.56	0.77	16.6	17.3
Health	0.13	0.35	0.63	21.9	34.2
Other	1.04	2.00	2.23	14.0	5.6
Private consumption	3.36	4.10	6.16	4.1	22.6
Education	0.46	0.44	0.59	–0.9	15.8
Health	0.21	0.26	0.39	4.4	22.5
Other	2.70	3.40	5.18	4.7	23.4
Less: labor income	6.58	10.43	12.74	9.7	10.5
Lifecycle age reallocation	–1.79	–3.41	–2.96	13.8%	–6.8%
Net transfer	0.11	0.23	0.16	15.9%	–16.6%
Asset income	1.30	4.68	6.50	29.2%	17.9%
Public asset income	–0.04	0.02	0.16		182.8%
Private asset income	1.34	4.65	6.35	28.3%	16.9%
Less: saving	3.20	8.32	9.62	21.1%	7.5%
Public saving	0.58	1.59	0.68	22.3%	–34.6%
Private saving	2.61	6.73	8.94	20.9%	15.3%

Source: Chinese Statistical Yearbook, various years. 2002 price is used as the base price.

export sector, its overall impact on China's economic growth was rather limited.

The extraordinary economic growth in the last decade and more has fundamentally remade the Chinese society. The explosive growth in income and wealth has laid a solid foundation for rising standards of living. The annual consumption per capita in urban households rose from 6030 RMB in 2002 to 16,674 RMB in 2012,<sup>5</sup> increasing by 9.8 percent annually, while the annual growth rate for rural households is even higher, at 11.4 percent.

China's historical economic boom has also led to an explosive expansion of the government coffers and to new government-sponsored social welfare programs. The reform of tax-sharing system since 1994 has entitled central government better access to tax revenues. Between 1993 and 2012, central government's revenue jumped from 95.8 billion RMB to 5.6 trillion RMB, by 57 folds, while local government's revenue also rose by 17 folds. With increased financial power and the willingness to improve social welfare provision, Chinese government launched a series of unprecedented social welfare policy initiatives in the last decade. These policy initiatives include mandating public funding for nine-year compulsory education in 2001, the New Cooperative Medical System (NCMS) for the rural population beginning in 2003, urban minimum wage in 2004, abolishing agricultural taxes in 2006, and establishing the new rural old age security scheme in 2009. These endeavors have all resulted in changes in public in-kind and cash transfers, which have profound implications in inter-generational income redistribution.

Estimation results of income, savings, and consumptions using the NTA method mirror those seen in the broad economic growth measures summarized above, and they portray a clear contour of the elements of China's spectacular economic change. In contrast to most developed countries (Kluge, 2011; Mason and Lee, 2011), China runs a negative lifecycle deficit, which in other words represents a lifecycle surplus. During the five years between 2002 and 2007, the size of lifecycle surplus almost doubled (Table 1). If we look into the left-hand side of Eq. (1), such a drastic increase in lifecycle surplus is driven first by the increase in labor

income, growing at about 9.7 percent per year. Consumption also shows an upward trend, but at a slower rate than labor income, increasing by 7.9 percent annually. In particular, private consumption only increased at an annual rate of 4.1 percent. The expanding power of the government is evident, with public consumption growing at a rate of 15.3 percent annually.

We further differentiate public and private consumption into three categories: education consumption, health consumption, consumption other than education and health.<sup>6</sup> Between 2002 and 2007, following the government mandate of public funding for nine-year compulsory education in 2001, the government invested intensively in promoting education and health, which largely alleviated the household burden. For example, public education consumption grew at an annual rate of 15.3 percent, in contrast to private education spending, which actually declined at an annual rate of 0.9 percent. By 2005, about one-third students receiving compulsory education in western and central rural areas were waived of textbook fees and miscellaneous fees. This preferential program reached all rural students in primary and junior high schools by 2007. Similarly, public health expenditures more than doubled in this five year period, following the New Cooperative Medical System (NCMS), piloted from 2003. Private health consumption, by comparison, increased by only 24 percent. In 2003, around 80 percent of the farmers were left uninsured (Wagstaff et al., 2009), by 2012 the NCMS has increased coverage to almost all rural residents (98%).<sup>7</sup> These income-enhancing and expenditure-reducing government programs not only affect the magnitude of public transfers in the life course, but could potentially also change the intra-household resource allocations.

As the right side of Eq. (1) shows, lifecycle deficit (consumption minus labor income) is financed in three ways: net transfers from the rest of the world, public and private asset income, and dis-savings. Identically, lifecycle surplus accumulates into savings net of net transfer and asset income. For China between 2002 and 2007, public and private savings both increased significantly, by 5.1 trillion combined, contributing to the dramatic increase in life-cycle surplus. Net transfers, equaling to disposable income minus primary income, comprised only a small portion of age reallocations, less than 7%. Asset income also experienced an explosive growth, especially public asset income. In 2002, the government ran a negative asset income, as interest payment was larger than interest income. However, public asset income turned positive by 2007. Private asset income also increased rapidly, by about three-folds. Though asset income grew at a rate that was faster than savings, its absolute volume was still smaller in comparison to savings due to its lower initial level. As a result, lifecycle surplus kept expanding (Table 1 and Fig. 1).

The two years between 2007 and 2009 show some very interesting changes in the Chinese economy. First of all, the direction of change in life-cycle deficit was reversed, with lifecycle surplus beginning to shrink, from 33 percent of the total labor income to 23 percent in only two years (Table 1 and Fig. 1). A major factor leading to this reversal seems to be the drastic spending down of the public savings, in the wake of the 2008 global financial crisis. In response to the crisis, Chinese government put together a stimulus package of 4 trillion RMB, of which 1.18 trillion came from the central government's coffer, spent over a three-year period between 2008 and 2010. The amount of public savings as shown

<sup>6</sup> Public consumption is equivalent to public in-kind transfer in the NTA framework.

<sup>7</sup> NCMS was heavily subsidized by the government, with 280 RMB per person annually from the government and individual contribution at 60 RMB in 2013. Overall payout rate from the insurance scheme is at around 50%. Starting in 2013, 20 illnesses listed under "catastrophic illnesses" can receive up to 90% reimbursement for treatment.

<sup>5</sup> Adjusted for the Consumer Price Index.

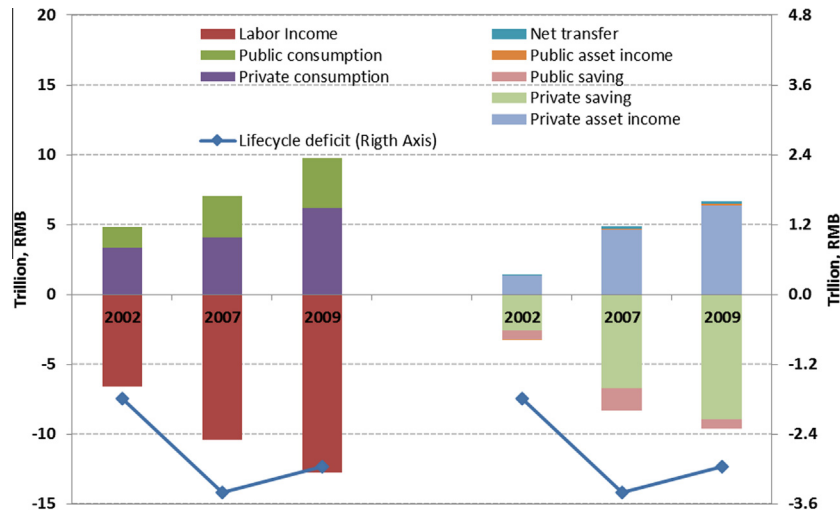


Fig. 1. Lifecycle deficit and compositions, China 2002, 2007 and 2009. Source: Authors' calculations based on Chinese Statistical Yearbook, various years.

here dropped almost 60 percent between 2007 and 2009. If we apply all 1.18 trillion RMB to be spent in a single year, 2009, as a way to gauge the effect of the stimulus program, not spending on the stimulus package would have increased lifecycle surplus between 2007 and 2009 by 12 percent, instead of reducing it by 13 percent (Table 1).<sup>8</sup>

While the spending down of the public savings is an outcome of the government stimulus program in response to the global financial crisis, the slower rate of private savings growth compared with the previous period is not. The sharp expansion of New Cooperative Medical Scheme in rural China, initiation of New Rural Social Pension insurance since 2009, and consecutive increase in pension for urban corporate retirees have lowered precautionary saving motivation, which partially account for the slowdown of private saving (Giles and Yoo, 2007). In comparison to the earlier period, public asset income growth maintained its upward trend, while the private asset income growth slowed down.

Parallel to increased government dissaving, the left side of Eq. (1) presents us another facet of the Chinese economy. The two-year period between 2007 and 2009 may be too short for making any definitive statements about future changes in life-cycle deficit in China, but several other changes are highly significant. Reversing the pattern seen for the time period of 2002–2007, during which income growth outpaced consumption, consumption started to grow at a rate faster than labor income between 2007 and 2009. Private consumption rose at an even faster pace than public consumption (Fig. 1 and Table 1). This trend is in line with the recent re-orientation of the Chinese economy. China has been relying heavily on export and investment to maintain its high-speed growth, while the lessons from the shock of global financial crisis reinforced the need for China to shift to a consumption-driven growth model. This change may be partially caused by the government programs in tapping domestic consumption, especially in unexploited rural markets. For instance, the government started in December 2007 to provide a 13-percent subsidy to farmers buying designated brands of color TV sets, refrigerators and mobile phones in Shandong, Henan, and Sichuan provinces and Qiangdao city, and the subsidy program was widened across the nation in February 2008.<sup>9</sup> The program stimulated sluggish rural consump-

tion. Home appliance sales in China's countryside jumped 67 percent year-on-year to reach 24.2 billion yuan in September 2011. The more rapid growth of private consumption may also be caused by other factors, such as consumption behavior and population age structure change, hence representing the beginning of a new era characterized by shrinking lifecycle surplus or increasing deficit. Together, slower growth rates in both labor and asset income, as well as in savings, and a faster rate of growth in consumption could suggest the arrival of a new era.

### Lifecycle patterns in income and consumption

Remarkable changes in income and consumption, both levels and age patterns, are clearly evident from the results based on Chinese household survey data. In Fig. 2, we present lifecycle per capita income and consumption profiles for China for 2002 and 2007. The first most noticeable change was in the levels of income and consumption. In the short five years, and confirming what the aggregate data reveal, both income and consumption levels increased rapidly. National labor income levels and consumption level increased in parallel, by 82 percent and 79 percent, respectively.

Two features highlight the reshaping of income profile over the individual lifecycle in recent China: stagnant earnings in the old age and an earlier arrival of the peak earning age. First, the increases in labor income concentrated at young and middle aged groups, while the elderly people aged above 60 barely benefited from the income increase. Such a pattern is partly due to older persons' low participation in the labor market, which is due to the early retirement regime in urban China and the depressing effect of improving social security benefits on labor incentives (Gruber and Wise, 2001).

Second, between 2002 and 2007, peak income earning ages moved down from around age 40 to around age 30, which is much younger than in other countries, developing and developed. For example, the peak age was 37 in Indonesia in 1996, and was 46 in Nigeriain 2004 (Soyibo et al., 2011). In more developed countries such as the US in 2000, Japan in 1999 and France in 1996, earnings peaked at the age of 48–49 (Lee et al., 2006).

Shifting peak ages in labor income occurred in both urban and rural China,<sup>10</sup> but may be due to different reasons. For the rural part,

<sup>8</sup> Because figures in Table 1 are inflation adjusted number, same adjustment factor is applied to the 1.18 trillion RMB stimulus package.

<sup>9</sup> The subsidies were capped at 2000 yuan for a color TV set, 2500 yuan for a refrigerator and 1000 yuan for a cell phone. The 13-percent subsidy was split 80 and 20 between the central and local governments, respectively.

<sup>10</sup> Due to space limitation, we do not present the age profiles of labor income in urban and rural China in the paper. These figures are available upon request.

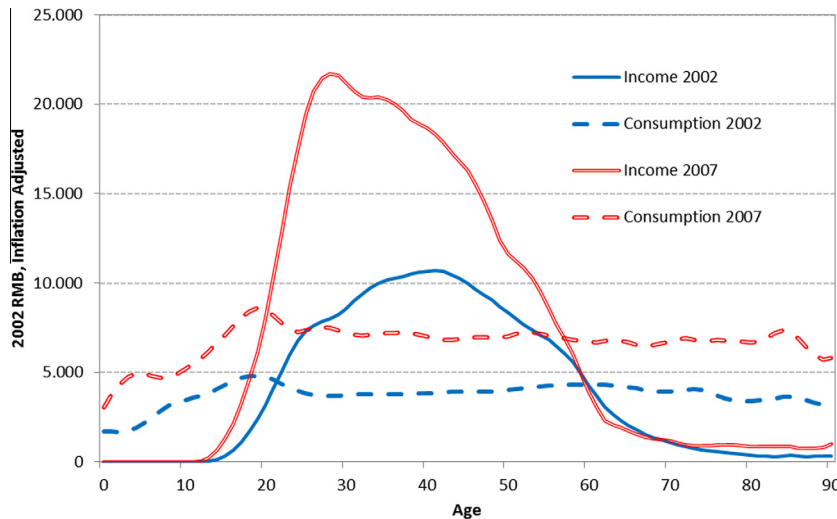


Fig. 2. Profiles of labor income and consumption, China, 2002 and 2007. Source: Authors' calculations based on data from China Household Income Project 2002 and 2007.

it was the result of two factors: employment type and demographic change. The first decade of the 21st century had the fastest labor transfer and urbanization in recent Chinese history, with rural dwellers especially rural young people moving out of the agriculture sector and into manufacturing and service sectors. Within one decade after 2000, the share of Chinese labor force primarily engaged in farming dropped from 50 to 37 percent, by far the largest exodus from agriculture ever in Chinese history. Higher non-farming wage income among the younger rural laborers, in comparison to the older laborers, who relied primarily on agricultural income, was one of the reasons for such a shift. The income advantage of those young rural migrant workers was further amplified by the shrinkage of labor supply. Between 2004 and 2006, for instance, wage level for unskilled laborers saw double-digit growth, much faster than in the preceding years (Du and Pan, 2009).

The shift in income profile among urban population, while may also be affected by the push-up effect of declining cohort size, was more likely due to another source: rapid expansion of higher education and the increased human capital among the younger urban employees. In the last two decades, China has seen the fastest expansion in higher education in its history. The share of the labor force population with college education doubled from 2.6% to 5.3% between 1990 and 2000, and doubled again to 12.5% by 2010. The increase in educational attainment was concentrated among the young, and especially among urban youths. China's 2010 census revealed that while among population aged 40–49 only about 7% received college or more education, among those aged 20–29, the share was three times as high, over 20%. In urban China, nearly 40% of those aged 20–24 in 2010, and nearly one third (32.5%) among those aged 25–29 were college educated. The corresponding numbers back in 1990 were 9.8% and 8.5% respectively.<sup>11</sup> With an economy that has been moving towards the high-tech and service, these young people with fresh college education are positioned to get into the higher paying jobs. In the case of China, we are witnessing a generational shift in earning capability as well as outcomes.

Increased educational attainment did not come as a free lunch. As shown in Fig. 2, age gradient in consumption was flat in China for adult ages in both years, similar to the case of Taiwan (Lee et al., 2006). Consumption, however, went up sharply in the ages between 10 and 20, largely due to educational cost. Chinese parents in other words spent heavily on their children's education,

to prepare them for success, whatever that means, in an increasingly competitive job market and society.

Two other changes in the consumption age profiles between 2002 and 2007 offer some hints to anticipate the future as well. The first is that consumption growth during the five years under examination is somewhat faster among the young and high earning population aged 20–40. A new consumer generation in other words has been born in China. The second change is that rising consumption has moved the ages by which lifecycle "deficit" stage begins and ends. The crossover point by which average labor income exceeded consumption was 22 in 2002 and 21 in 2007, and the crossover point by which labor income went below the consumption level was 60 in 2002 but only 58 in 2007. Going into deficit at the late-50s was early in comparison with other societies. For instance, lifecycle deficit occurred at age 63 in Nigeria (Soyibo et al., 2011), and the same in five Latin American countries on average, Ecuador, Honduras, Mexico, Nicaragua and Peru (Cotlear, 2011). With rising life expectancy, income dropping below the consumption level at such early ages means more years required to receive support from others, through transfers, asset income, or spending down of savings. This is likely to be a long lasting challenge for China.

Combined, what do the current economic abundance as seen in aggregate lifecycle surplus and changes in individual lifecycle income and consumption pattern suggest for China's future? Answers to such a question depend on future changes in income and consumption profiles, and on population age structure.

### Population aging and economic change: When might the abundance end?

Population aging is unfolding with an underappreciated pace in China. China's latest census revealed that China's population aged 60 and above reached a total of 178 million, accounting for 13.26% of the total population, up by 2.93 percentage points in just one decade, both numbers are higher than the official Chinese government's projections and that of the United Nation's (Cai, 2013).

Decades of continuous rising in longevity and below replacement fertility have pushed China into an era of accelerated aging. In countries like Italy, Germany, and Russia, it takes 70–80 years to increase its share of the elderly aged 65 and over from 9 percent, China's level in 2010, to 25 percent. In China, the time span will be less than 30 years. The UN's (2011) medium fertility variant projects that the total population aged 60 and above in China will

<sup>11</sup> These numbers are based on China's 1990, 2000, and 2010 censuses.

increase to 340 million by 2030, accounting for 24% of the total population, and to 440 million by 2050, accounting for 34% of the total population. Even its high-fertility variant still sends the proportion of 60 and above to over 30% before leveling off.

As have been observed in other countries, aging is expected to affect the balance of lifecycle deficit (or surplus) directly through changes in composition of population, and indirectly through changing individual economic behavior and overall economic performance. Population aging, in the context of low fertility and limited social welfare, requires families to save more for old age. Such a demand faces intense competition from needs for investment in children's education, and rising living expense. Population aging also changes the dynamics of the entire economy. China's rapid growth over the last three decades has relied heavily on cheap young labor. Disappearance of abundant cheap young labor could lead to two different outcomes: one that China loses to competitors in the international labor division, the other that China needs to upgrade its economic structure. The first would mean stagnation or even a negative growth in the economy that depresses the income profile; and the second would mean that rising of income continues and expands into older ages. Population aging leads to changes in the consumption structure. One big unknown factor in the balance of lifecycle deficit is the cost of health care. Without a solid public social security system, uncertainty about future could also lead to frugal spending.

With rapid and sustained population aging, the questions are whether the surplus will last, and when it will end. Answers to these questions will of course depend largely on economic growth. Nevertheless, an application of the NTA approach based on what we have presented above and experiences from Taiwan can shed light on China's future trajectory, especially the effect of population aging.

China's recent abundance in lifecycle surplus is in part attributable to its still relatively favorable population age structure. In Table 2 we compare two sets of labor income and consumption totals, one from SNA data, as we have shown in Table 1, and one from NTA profiles applying to a stationary (life table) population.<sup>12</sup> The NTA profile totals can be interpreted as the total labor income and consumption for a synthetic cohort living through life table mortality. The ratio of total consumption to labor income indicates the relative size of lifecycle deficit – a ratio lower than 1 means surplus and higher than 1 means deficit. According to the SNA data, the ratio of consumption to labor income dropped from 0.728 in 2002 to 0.673 in 2007, and then increased to 0.768 in 2009. Even with the fluctuation, these ratios indicate a large proportion of labor income in China is saved, i.e. as a surplus. The change in NTA profile ratios follows the same trajectory as the SNA ratios. The ratio of consumption to income dropped from 0.800 in 2002 to 0.771 in 2007, and then increased to 0.882. Calculations incorporating population age structure reveal a smaller (relative) surplus. These side-by-side comparisons illustrate that a major part of China's negative lifecycle deficits (or surplus) is from its favorable population age structure. Rapid and sustained population aging is expected to change the ratio between consumption and labor income at the society level. The decline in the magnitude of lifecycle surplus between 2007 and 2009 has already offered some hints that China's huge surplus is not going to last forever.

To gauge the effect of population aging on China's<sup>13</sup> lifecycle deficit, we use Taiwan's well-documented experience over the 20 years between 1980 and 2000 as a reference case. Taiwan is chosen not only because it shares many social and cultural background characteristics with China, but also because it is one of the most

**Table 2**  
Ratios of total consumption to labor income, China 2002, 2007 and 2009.

Year	National total (Trillion RMB)			NTA profile stationary total		
	Consumption	Labor income	Ratio	Consumption	Labor income	Ratio
2002	4.793	6.583	0.728	2.676	3.344	0.800
2007	7.017	10.426	0.673	4.753	6.166	0.771
2009	9.780	12.739	0.768	7.010	7.946	0.882

Source: Chinese Statistical Yearbook, various years. 2002 price is used as the base price. The NTA Profile Stationary Total is calculated using the 2000 life table population.

studied and understood NTA cases (Lee and Mason, 2011). In Fig. 3 we compared Taiwan's labor income and consumption profiles of 1980 and 2000 with those of China in 2002. In order to make age profiles comparable between China and Taiwan, all measures were normalized to the average labor income of prime working age (30–49) following the method of Lee and Mason (2010). Taiwan's labor income age profile changed little between 1980 and 2000, with the exception of a labor income drop shifting leftwards for about 5 years – reflecting possible decline in income from self-employment especially from family farming over time. Change of Taiwan's consumption profile is more in level than in shape. The increase in consumption is largely across the board with somewhat larger increases in the young and old ages – reflecting rising education expenditure and healthcare cost. These changes are similar to those in China between 2002 and 2007 (Fig. 2). Adding China 2002 to the picture, China's labor income profile is very similar to Taiwan's in 2000; China's consumption profile has a similar shape to Taiwan's, but at a much lower level. Using prime working age (30–49) as index, the level of consumption as percentage of normalized prime working age labor income was 48.4% and 60.1% for Taiwan in 1980 and 2000, and 38.7% and 44.0% for China in 2002 and 2007, respectively.

To examine the effect of population aging and lifecycle economic profiles on future needs for intergenerational transfers, we carry out projections by setting different ratios of consumption relative to average prime working age (30–49) labor income. NTA data suggest that the rise of Taiwan's consumption relative to prime working age labor income ratio is a gradual process. It is safe to assume that this will be the case in China as well. We use the United Nations (2011) population projection (medium fertility variant) as the base population. A total of 8 projections are presented in Fig. 4: two based on empirical NTA profiles observed in 2002 and 2007, six by scaling the relative consumption level to 50%, 55%, and 60%, and using normalized NTA profiles observed in 2002 and 2007 as the base, respectively. The projection sets the average labor income of prime working age (30–49) at 1, thus leaves out possible complications associated with economic price fluctuation. The aggregate lifecycle deficit for each year is measured as the number of person-year equivalent of prime working age income.

A major source of China's current abundance is amply evident in Fig. 4: China's extremely low level of consumption. In 2007, at prime working age an average person only consumed less than 45 percent of his/her labor income. Should such a pattern of low consumption continue, the low consumption will overpower the effect of aging (Projections #1 and #5). The expected rapid aging in China would only reduce the size of lifecycle surplus, but not erase it. The surplus would continue all the way to the end of this century. Nevertheless, both Projections #1 and #5 indicate that China either is reaching or has already reached the peak of lifecycle surplus.

However, even a modest increase in consumption level would eat away China's lifecycle surplus. Should China increase its consumption level to 60%, a level still below Taiwan's level in 2000,

<sup>12</sup> Life table from 2000 census ( $e_0 = 71$ ) is used here.

<sup>13</sup> "China" in the following description refers to "mainland China".

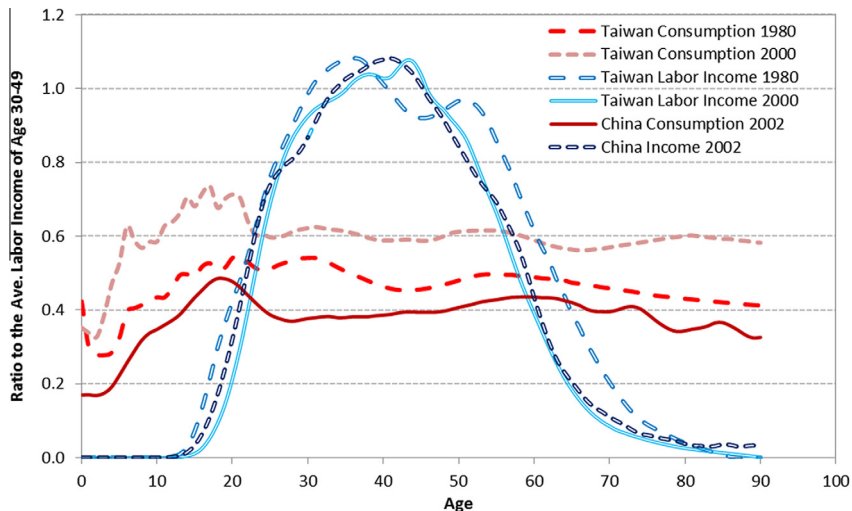


Fig. 3. Comparison of NTA normalized profiles, Taiwan 1980/2000, China 2002.

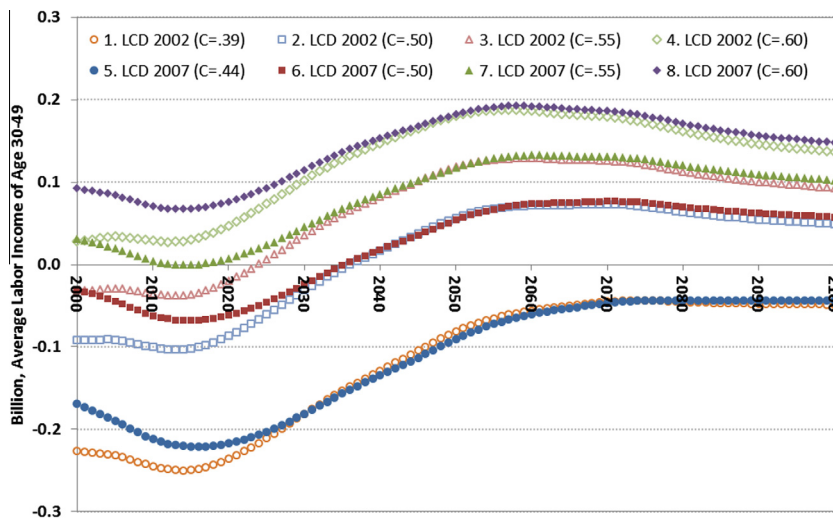


Fig. 4. Effect of population aging on lifecycle deficit, China 2000–2100.

there would be no surplus, even under the current very favorable population age structure (Projections #4 and #8). Aging would push China's lifecycle deficit to over to 190 million person-years of prime working age labor income in the middle of century with either the 2002 or 2007 age patterns of consumption and income (Projections #4 and #8). Between these two ends were projections that assuming a level of consumption either at the 50% or the 55% level. Three projections (#2, #6, and #7) suggest that China would run out lifecycle surplus by 2035, 2023 and 2035, respectively.

The projections also suggests that a change in labor income profile will only have a limited effect on China's future lifecycle deficit, if China's fertility stabilizes at a below replacement level as specified by UN's projection. As shown in Fig. 2, there was already a major shift in China's labor income shape between 2002 and 2007. The effect of income change on lifecycle surplus was captured in the differences between corresponding projections that shared the same level of consumptions, e.g. #1 vs. #5, or #2 vs. #6. The difference caused by shifting labor income profiles became very small after 2030, as birth cohort size has become relatively stable after 1990.

Together, the 8 projections shown in Fig. 4 demonstrate the power of population aging over China's economic future. By focus-

ing on population aging, and with assumptions of different ratios of consumption and labor income, these 8 rather simplistic projections together shed light on the possible scenarios of China's future economy. With expansion of social welfare programs, increase in public spending, and a rise in the individualistic culture, China's consumption level is expected to rise. In fact, many politicians and economists count China's increasing domestic consumption as the new engine of future economic growth, as the other two engines, investment and export, are losing their steams. Our projections show, however, that China will face a challenge in finding a balance between rising level of consumption and expanding lifecycle deficit. The projections indicate that the room for maneuver is relative small. China clearly does not have the luxury of pushing its consumption level to 60%. The projections suggest that China's age of abundance will end before 2035 even if China can manage to keep the level of consumption at 50–55% of prime working age labor income.

**Conclusion and discussion**

Both wealth and aging have arrived in China. As with all great transformations, China's historical economic boom comes with



enormous discontinuities and disruptions. In the case of China, its economic growth is accompanied by a great generational shift, and has taken place while a new demographic transition is unfolding. While China's spectacular rate of income increase and wealth accumulation is slowing down, its rapid pace of population aging is continuing. What distinguishes China from other aging societies, as has been frequently noted, is the unpreparedness of China's social and economic infrastructure when the population becomes old. At China's current level of population aging, other societies had already achieved a much higher level of standard of living. In contrast to China's 7500 USD (PPP) per capita income level in 2010, Japan had an income level twice of China's, Taiwan more than twice, and South Korea nearly three times. Moreover, these and other aging societies had also had in place a stronger social infrastructure, with a better pension and health care system, and without the large share of families with only one child.

Under the framework of the National Transfer Account, our analysis of recent changes in economic profiles from an intergenerational perspective offer some hints on future economic trajectories in China. First of all, the specific historical conditions that led to the increase in lifecycle surplus we document in this paper are no longer present. It is therefore safe to conclude that the increase in lifecycle surplus will not be repeated. Economic growth may continue, though likely at a slower rate, and so will labor income. Following the period of growth in which land prices and property values are reaching stratospheric levels in the last decade, it is unlikely that such rapid increases are going to be repeated. Changes between 2007 and 2009 actually have already started to confirm such a direction of change, namely that the rates of growth in asset incomes and in savings are slowing down (Table 1).

Second, what has also emerged as a new feature of the Chinese society is that with increased education and income, consumption, especially private consumption, is picking up speed. The young Chinese, especially those in cities, are earning more and also spending more, unlike their parent and grandparent generations. Researchers have shown that the cohort who have experienced the Great Famine during 1959 and 1961 tend to repress their consumption, which partly accounts for the sluggish domestic demand and high saving rate in China (Cheng and Zhang, 2011; Harbaugh, 2004). However, this cohort with higher earnings and low consumption tendency will be replaced by a new consumer generation. Our projections suggest that a modest increase in consumption level combined with the rapid population aging will erase China's lifecycle surplus by around 2035.

Third, with the eventual ending of the current lifecycle surplus in sight, China's economic reforms will need to focus on labor income and returns to assets, which are two primary sources of resource generation. China's past investment and continued improvement in its higher education and in society-wide investment in technological innovation are already showing benefits, and will have to play important roles in the future as well. China's existing early retirement age leaves much room for increased labor market participation and reduced demand for pension payout. Postponing retirement or flexible retirement regime may enable the elderly to benefit from economic growth and realize higher income at their 60s, and at the same time reduce the burden of state pension payout. Reforms in the financial institutions are a necessity to make sound use of the massive savings, creating higher asset income especially for the elderly.

China has gotten old before getting rich, but the riches it has accumulated so far lend China some precious opportunities to prepare for further population aging in the most populous country in the world. How China seizes this small window of opportunities with prudent economic and policy reforms will determine the country's future.

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