China's Demographic Change in Comparative Perspective: Implications for Labor Markets and Sustainable Development

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I. Introduction

China is undergoing at least three intertwined transitions. The *demographic* transition refers to the change from high and fluctuating birth and death rates to relatively low and stable ones. Control of infectious disease—which was central to the decline in death rates—also spurs the *epidemiologic* transition to chronic disease as the primary health threat, associated with urbanization and more affluent and sedentary lifestyles. These in turn are linked to China's third, *economic* transition from an agricultural and once centrally planned economy into a middle-income, market-based economy. The legacy of this transition is still evident in large urban-rural differences in work and social welfare entitlements.

The combination of these three transitions makes contemporary China distinctive.[1] However, many aspects of China's demographic change are emblematic of the forces shaping emerging markets more broadly—and indeed, of the demographic forces shaping global labor markets, as discussed by David Lam and Ronald Lee in their contributions to this volume.

As is well known, unprecedented economic growth in China spanning the last three decades has lifted hundreds of millions out of poverty and restored China to the prominence in the world economy that it once enjoyed centuries ago. Demographic change not only shapes the trajectory of that development, but interacts with macroeconomic and microeconomic forces in ways that I will briefly attempt to illustrate, in comparison with India (the other "demographic billionaire") and other emerging markets, as well as compared to the U.S. and other high-income economies.

Four main points emerge. First, as the result of low fertility and longer, healthier lives, China's population is rapidly aging. Second, this demographic transition shapes work-lives, with estimates showing that Chinese spend a declining share of life expectancy in the labor force, albeit with large cohort and urban-rural differences associated with evolution of human capital. Third, demographic change is not just population aging; importantly for China, large gender imbalance will also shape the population for at least a generation. Fourth, these demographic changes hold profound challenges for social policies, especially health insurance and pension systems.

To make these points, I draw from multiple sources of survey data, national statistics and analyst projections, acknowledging the large uncertainty of most projections. The point is not the specific numbers so much as the broad trends with which future policies will need to contend.

II. China's Demographic Transition in Comparative Perspective

Most demographers agree that the question of demographic transition for an economy is no longer "whether," but "how fast" (Lee 2003). One of the most important regularities of human history, the demographic transition in the long run is interlinked with many of the social transformations associated with modern economies. Lee and Reher (2011) argue that the demographic transition "made possible the radical change in women's economic and social roles; the invention of retirement as the third stage of life; and a demographic efficiency that fostered heavy investment in the human capital of fewer but longer-lived children" (p.1).

Although the fundamental trigger for the transition—especially fertility reduction and its sequencing—remains debated (Guinnane 2011), increases in per capita income have almost universally gone hand in hand with increases in life expectancy (Preston 1975). Mortality decline followed from improvements in nutrition (Fogel 1994; Barker 1992) and reduction in infectious disease, partly through advances in preventive medicine such as vaccines (dating to the smallpox vaccine in the late 18th century) and antibiotics, as well as scientific advances in public health such as clean water and waste disposal systems (Lee 2003; Costa 2013). The increasing capabilities of medicine have reduced premature mortality from chronic diseases such as heart disease and cancer, leading to a significant increase in life expectancy at older ages (Cutler, Deaton and Lleras-Muney 2006). Population aging is a worldwide phenomenon, with important implications for economic growth (Bloom, Canning and Fink 2010). Since even the highest-income countries continue to see their population age structures evolve to larger proportions of elderly, no country has "completed" its demographic transition (Lee 2003).

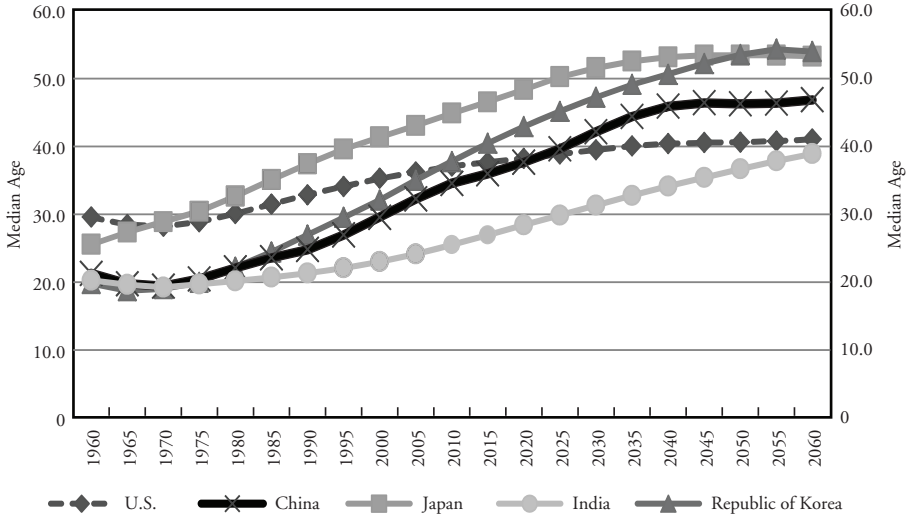
II.i. China's Population Structure, 1960-2060

With over 1.3 billion people, China is the most populous country in the world. Life expectancy has increased from 50 in the 1960s, to 65 in the 1970s and to 72.54 for men and 76.77 for women by 2010 (U.S. Census Bureau life tables for China).

Chart 1 draws from the U.N. medium variant prediction to illustrate the increase in China's median age between 1960 and 2060. Within the next decade, China is projected to have median age greater than that of the U.S.—at a much lower level of per capita income. As also shown in Chart 1, Japan has among the oldest age structures ever observed in any society, stemming from earlier, continuing longevity increases and below-replacement fertility. Perhaps less well-known is that South Korea is aging even more rapidly, with median age now above that of the U.S. and converging to the extremely high level of Japan.

Median age is increasing because of the changing age structure, as shown for China in Chart 2, drawing again from the U.N. median

Chart 1
Median Age in Asia in Comparative Perspective, 1960-2060

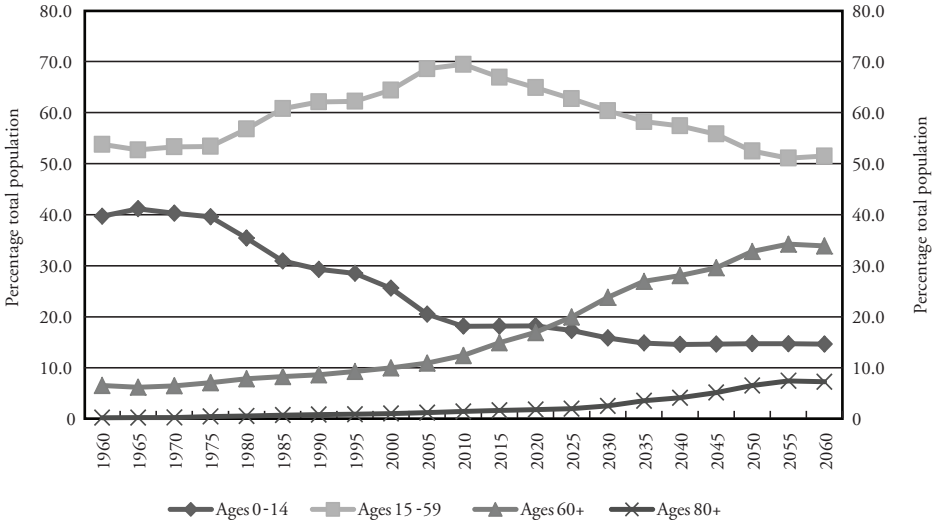


Source: United Nations, *World Population Prospects: The 2012 Revision*. Medium Variant.

variant projections. The share of working-age population (illustrated here with those ages 15-59) peaked recently, and has begun a steady decline. A "demographic dividend"—a one-time boost in GDP per capita—occurs when the working-age share of the population is relatively high, if that population is productively employed (Bloom, Canning and Sevilla 2003). The demographic dividend is estimated to account for 15 percent to 26 percent of China's rapid growth since late 1970s (Bloom and Williamson 1998; Wang and Mason 2008), but now is fading into history.

Following the large reduction in fertility beginning in the early 1970s, spurred by socioeconomic change and the "Later—Longer—Fewer" family planning campaign (before the one-child policy), China's population share of children has declined substantially (Chart 2). Even this cursory glance at demographic trends foreshadows the importance of continued investing in nutrition, education, and skills per child in China, to spur productivity in combination with urbanization, industrialization, "catch-up" in technology and shift from imitation toward fostering innovation.

Chart 2
Structure of the PRC Population, 1960-2060



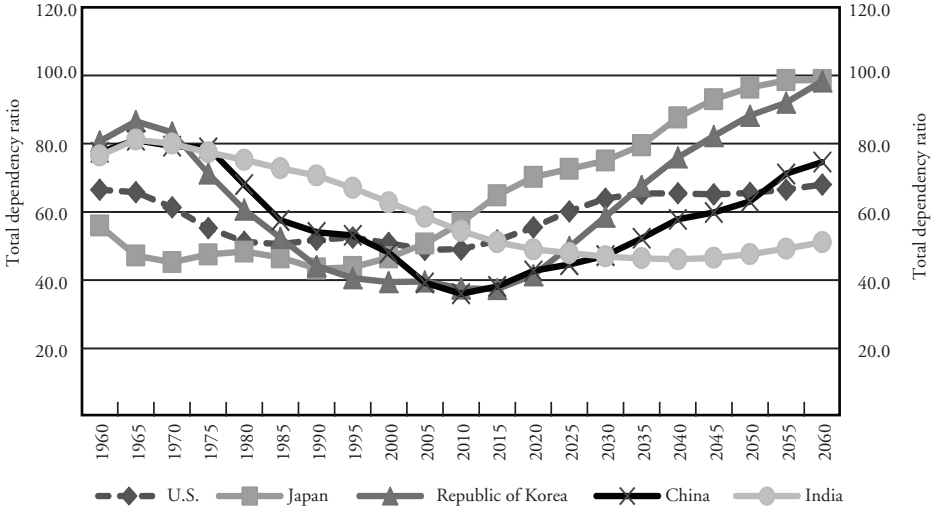
Source: United Nations, *World Population Prospects: The 2012 Revision*. Medium Variant.

China's population ages 60 and older is projected to increase from one-tenth of the population in 2000 to one-third of the population by 2060. Notably, Chinese ages 80 and older will then represent the same share of China's population as those ages 60 and older did in 1980, at the beginning of the reform era.

Absolute size also matters. China's total population is projected to increase until 2030, peak at about 1.45 billion, then slightly decline. China had about 20 million "oldest old" (elderly 80 and older) in 2010. In the U.S., aging of the baby boomers will swell the ranks of the 65 and older population from 43 million to 76 million people over the next 20 years. But in China by 2045, the population 65 and older will exceed the entire current U.S. population, and Chinese ages 80 and older will number about 73 million, greater than the current population of France.

This evolution of China's age structure has led to a total dependency ratio (roughly the ratio of the young and old to those in working ages) that reached its nadir a few years ago and is now projected to increase steeply, exceeding that of the U.S. by about midcentury

Chart 3
Total Dependency Ratios in Asia in Comparative Perspective, 1960-2060



Source: United Nations, *World Population Prospects: The 2012 Revision*. Medium Variant.

(Chart 3). Dependency in Japan and Korea will be much higher. By contrast, India is aging at a much more leisurely pace, and the decrease in youth dependency will offset the increase in old-age dependency for a few more decades. After 2030, total dependency in India will be lower than that of China, with an enlarging dependency gap between these two Asian giants. Thus, as China's economy faces the headwinds of aging, India faces the challenge of fully capturing its "demographic dividend" (Bloom and Eggleston 2014).

Demographers inside and outside China have long urged the government to relax the one-child policy, given the economic and social strains likely to ensue from China's rapidly aging population (e.g., Peng 2011; Eggleston et al. 2013). Recently, China's new leadership announced relaxation of family planning policies along these lines, i.e., a national two-child policy for couples in which either the husband or the wife is from a single-child family. Fertility response to this policy will modify the aforementioned population projections. By increasing fertility in the short-run, the new two-children-for single-child-parents policy implies a short- to medium-run *increase* in

the dependency ratio, as a larger number of dependent children join the dependent elderly; but in the longer run this policy will offer a more sustainable trajectory for the workforce and elderly dependency ratio. Experts differ on the estimated overall impact, but most agree it will be modest. For example, demographer Li Shuzhuo (2014) predicted that the relaxed one-child policy will precipitate 15 million to 20 million additional births (second children), so that the total fertility rate will increase, but to no more than replacement levels.

Once this new policy is fully implemented, millions of parents who themselves never had a brother or sister will have the opportunity for their children to grow up with siblings. This is a crucial arena of choice restored to the Chinese, and will eventually make it easier for current generations to fulfill their obligations and desires for filial piety to China's burgeoning number of elderly. However, the effects on the population age and gender structure will not be felt immediately. In the meantime many pressing issues of health, education and investment in China's future generation need to be addressed.

II.ii. China's Longevity Transition

The driving force behind the changing age structure, apart from reduction in fertility, is the "longevity transition" that continues to raise life expectancy, with most increases in survival now accruing late in the lifespan (Eggleston and Fuchs 2012). In fact, "mortality is declining as rapidly in those countries like Japan and Sweden where it is already lowest, as it is in lagging countries like the U.S., suggesting that life expectancy is not yet approaching a biological limit" (Lee 2011, p. 571). Moreover, life expectancy could further dramatically increase if individuals and societies adopted even part of the currently known life-extending behaviors and policies—eliminating obesity, tobacco use and alcohol abuse; increasing physical activity, healthy diets and safe driving; and so on (Oeppen and Vaupel 2002).

Chart 4A uses the example of Sweden, a country with excellent demographic data as far back as 1900, to illustrate the century-long shift in distribution of decreases in death rates by age group.[2] In the first two quarters of the 20th century, mortality decreases were concentrated among infants and young children. During the second

Chart 4A
Decrease in Death Rates by Age Group in Sweden, 1900-2005

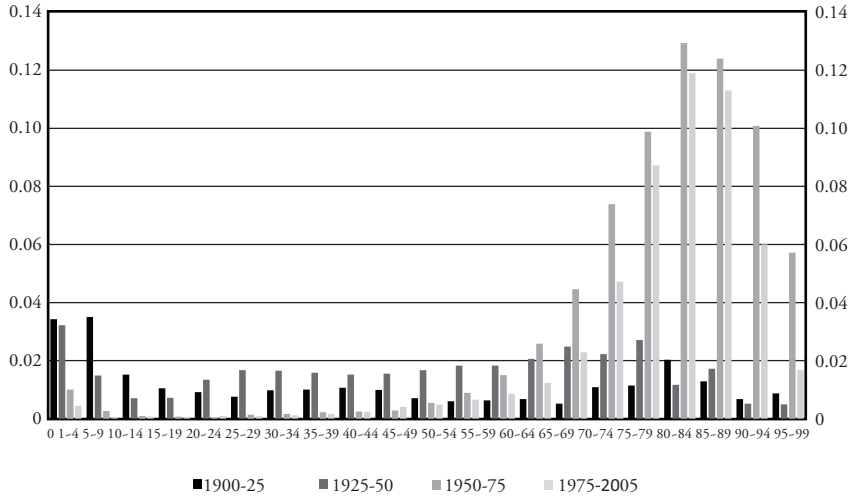
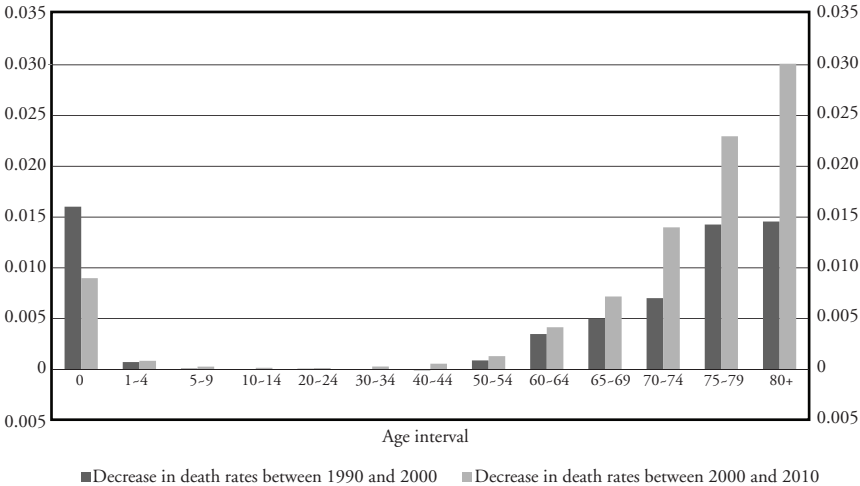


Chart 4B
Decrease in Male Death Rates by Age Group in China, 1990-2000 and 2000-10



two quarters the century, mortality decline was greater among those ages 60 and above.

China's improvements in death rates by age group show the same shift (Chart 4B) in just two decades: between 1990 and 2010, the distribution of decline in death rates for Chinese males changed from one with largest decreases in infancy to a distribution with the largest decreases after age 60.[3]

Eggleston and Fuchs (2012) calculated the share of increases in life expectancy realized after age 65 for the United States and 16 other high-income countries. That share averaged only about 20 percent at the beginning of the 20th century, but rose to about 80 percent by the end of the century. In the most recent 20-year period, fully 87 percent of Japanese women's increases in life expectancy were realized after age 65 (see Table 1). The share was 52 percent for Chinese men and 41 percent for Chinese women, and was much lower in India and other Asian developing countries at earlier stages of the demographic transition.

Extending that analysis into the future, I draw upon projections of PRC life expectancy based on Lee-Carter models as calculated by Lu, He and Piggott (2014). I calculate that of China's increase in life expectancy at birth in the next two or three decades, about two-thirds will be realized after age 65.

As a result of these shifts in survival and morbidity in China, except for the poorest rural areas, improvements in future longevity will tend to lengthen retirement rather than working lives (Eggleston et al. 2013). Although grandparents do provide substantial childcare and other nonmarket services in China, the longevity transition implies a decrease in working years as a percentage of life expectancy and a challenge to social support systems because of the growing needs to finance medical care and pensions, as discussed in the next section.

III. Implications of the Longevity Transition for the Workforce

The increase in share of survival gains realized late in life has important economic and social consequences. Demographers, actuaries

Table 1
The "New Demographic Transition" in Asia and Select Developing Countries

Country (Years)	Change in years lived past 65 as a percentage of change in life expectancy at birth	Male expected labor force participation as a percentage of life expectancy at birth (XLFP/LE), 2007
Japan (1990-2009)	Males 72.7%, Females 87.0%	54.1%
Taiwan (1990-2010)	Males 75.5%, Females 75.1%	–
South Korea (1990-2010)	Males 45.4%, Females 57.1%	52.0%
China (1990-2010)	Males 51.9%, Females 40.6%	57.6%
Philippines (1990-2010)	Males 26.2%, Females 36.0%	59.6%
Indonesia (1990-2010)	Males 26.1%, Females 35.7%	64.5%
Brazil (1990-2009)	Males 34.2%, Females 35.0%	59.1%
Vietnam (1990-2010)	Males 32.5%, Females 34.7%	54.6%
India (1990-2010)	Males 23.6%, Females 25.8%	60.0%
Bangladesh (1990-2010)	Males 20.7%, Females 25.4%	60.9%

Source: Eggleston and Fuchs 2012, Appendix Table 9. Authors' calculations based on life tables for each country or region prepared by the International Programs Center of the U.S. Bureau of the Census in its International Data Base and labor force participation data from the ILO.

and others have long realized that gains in longevity are distributed across the lifespan, and that the distribution of gains in survival has important implications for the balance of production and consumption, as well as for the finances of transfer programs like Social Security (Lee and Tuljapurkar 1997). However, the broad implications of this longevity transition have not generally been well recognized beyond a coterie of specialists in the field. That the Jackson Hole Economic Policy Symposium includes a panel on demographics demonstrates foresight regarding the importance of these trends.

The macroeconomic implications of the longevity transition depend upon behavioral and policy responses. Foreseeing longer lives, individuals might choose to work longer and save more, or consume less per year in retirement, or extract more transfers from the younger generation within the household or through public policies, or some combination (Eggleston and Fuchs 2012; Poterba 2014). Developing countries have the opportunity to establish sustainable institutions and avoid dysfunctional incentives (embedded in some OECD country social protection systems before their longevity transition), such as policies that discourage working past age 60.

III.i Estimating Expected Labor Force Participation

One metric for quantifying workforce changes is expected lifetime labor force participation (XLFP)—the number of years that an individual would expect to be in the labor force, based on survival to each age and age- and sex-specific labor force participation rates prevailing as of a given date (Eggleston and Fuchs 2012).

The far right column of Table 1 presents estimates for male XLFP as a share of life expectancy. For countries at the early stages of demographic transition at the bottom of the table, men can expect to be in the workforce for more than 60 percent of their lives. That share drops closer to 50 percent among countries farthest along in the demographic transition, like Japan. The estimate for China as a whole in 2007 was 57.6 percent, according to International Labor Organization data on labor force participation rates aggregated across men and women and urban and rural areas.

To develop an alternative estimate that disaggregates XLFP, I drew upon the age- and sex-specific employment rates reported in the China Health and Retirement Longitudinal Study (CHARLS) national baseline survey of 2011 to estimate XLFP for Chinese urban and rural men and women.[4] The estimates use the U.S. Census Bureau life table for China (as cited in Eggleston and Fuchs 2012) and assume that Chinese ages 20 to 44 participate in the labor force at the same rate as that of employment among the youngest CHARLS respondents (ages 45-49).

Table 2
Expected Labor Force Participation in China and the U.S., in Years and as Percentage of Life Expectancy at Birth

	China 2010			
	Men		Women	
	Rural	Urban	Rural	Urban
XLFP (years)	43.8	34.3	39.0	25.0
XLFP/LE	60.4%	47.3%	50.9%	32.5%
	United States			
	Men		Women	
	1950	2007	1950	2007
XLFP (years)	41.3	39.0	16.9	33.5
XLFP/LE	63.2%	51.6%	23.8%	41.5%

Notes: Following Eggleston and Fuchs (2012), XLFP is expected labor force participation, calculated as expected years in the workforce, taking account of survival to each age and age- and sex-specific labor force participation rates. Figures for the U.S. in 1990 and 2007 come from Eggleston and Fuchs (2012), Table 1. Figures for China are author calcluations based on age- and sex-specific employment rates, by urban/rural residence, reported in the China Health and Retirement Longitudinal Study 2011-12 baseline survey. Survival estimates for China are based on the China lifetables from the US Bureau of the Census for men and women (without differentiation by urban/rural residence, so life expectancy is slightly overestimated for rural residents and slightly underestimated for urban residents).

The CHARLS data reveal that employment differs strikingly between men and women, and urban and rural areas. Retirement comes sooner in urban areas, especially for women. In rural areas, more than half of men and women are still working at age 65. By contrast, fewer than half of urban women are working at age 50, and fewer than half of urban men are working at age 60. These represent large reductions from the era of central planning or the early reform era. As recently as 1988, "the employment rate for urban *hukou* holders, aged 16 to 64, was 83 percent for men and 75 percent for women" (Meng 2012, p.78).[5]

Table 2 reports the resulting estimates of expected labor force participation in China, in years and as a percentage of life expectancy at birth. Rural men could expect to spend about 44 years in the labor force—almost a decade longer than urban men. Chinese women's formal work lives are shorter, especially in urban areas, consistent with the unusually low pensionable age (55 or even 50), and lower wages than men with similar education and experience, on average.[6] Although women may be supplying childcare services for their

grandchildren and long-term care services for their spouse and others, their employment in the formal labor market is relatively short. Nevertheless, Chinese urban women's XLFP of about 25 years is still higher than that of U.S. women as recently as 1970 (see Eggleston and Fuchs 2012, Table 1).

III.ii Demography, Health and the Evolution of Labor Force Participation

In the U.S. and many other high-income countries, XLFP as a percentage of life expectancy has declined for both men and women since about the year 2000, portending an era in which increased survival contributes far more to consumption than production, and potentially strains the social contract between generations.

Some of the same forces are at work in China. Pressures to reduce work life as a share of life expectancy include:

- more years of schooling;
- the shift away from artificially high labor force participation under central planning;
- pension policies designed for an earlier era of shorter lives and an urban minority working for state-owned enterprises; and
- increased demand for leisure, as incomes rise.

Against this array of forces, longer survival and reduced morbidity push in the opposite direction, tending to raise labor force participation.

For example, I estimate that improved survival since 1990 increased working lives by about two years in China, holding age-specific labor force participation rates constant. Consider the counterfactual XLFP calculated using 1990 sex-specific survival rates to each age, but holding age- and sex-specific labor force participation rates constant at their 2010 values. If rural men faced risk of death as in 1990, their 2010 work life would have been 2.4 years shorter because of premature mortality, but work life would represent a higher share of life expectancy at birth (by a little over 1 percent). For urban men with 1990 survival, working lives would have been 1.5 years

shorter. The corresponding numbers for rural and urban women are 2.3 and 1.2 years, respectively. Thus, improving survival contributed nontrivially to expected labor force participation increases in China, ceteris paribus.

A critical question for the future will be how age-specific labor force participation rates evolve. Although our analyses are mostly "just" an accounting exercise, the importance of behavioral change can be highlighted by such decompositions of the changes in expected labor force participation into changes in survival and age-specific labor force participation. For example, consider an analyst of the U.S. economy in 1900 who naively assumes constant age-specific labor force participation rates into the future. Projections of XLFP would have been widely off the mark, even if correctly foreseeing increased survival. In particular, such an accounting approach would have underestimated the true increase in female XLFP by 90 percent, and overestimated the increase in male XLFP by 80 percent, because age- and sex-specific labor force participation rates changed significantly over the 20th century (Eggleston and Fuchs 2012).

Further evidence regarding the evolution of work-lives comes from estimates of consumption and income by age from National Transfer Accounts (*www.ntaccounts.org*), a project that Ronald Lee has pioneered and covers in greater detail in his contribution to this volume. Chen and Lee (2014) show that in 1995, the "cutting ages"—ages where the income curve cuts the consumption curve—were 20 and 60, for a working life of 40 years. By 2009 (the latest NTA available for China), the cutting ages were 21 and 56, for a 35-year work-life—although more Chinese were surviving into the working years and beyond.[7] In India, the corresponding cutting ages were 27 and 59, for a "work-life" of 32 years (Chen and Lee 2014)—despite India's younger demographic, more rural populace and lower investments in education, especially for girls. For comparison, in the U.S. in 2003, the cutting ages were 26 and 59, representing a 33-year "work-life" of income exceeding consumption (Chen and Lee 2014).

Public policies can and should play an important role in shaping labor force participation. Almost surely XLFP for Chinese urban

workers will have to increase, "nudged" by policies such as a preannounced increase of the pensionable age to 65 for both men and women.

Why haven't China's authorities raised the retirement age sooner? Arguably they should. However, it is important to remember that for China (as in many rapidly developing countries), there are large cohort effects that render the average mature worker far from a perfect substitute for a young worker. In particular, the current elderly have much lower educational attainment than their children and grandchildren. Fully 36.5 percent of the 60 and older population had no formal schooling, according to the CHARLS sample (CHARLS Team 2013, p.9). Table 3 shows educational attainment among men and women in China for specific age groups in 1950, 1980 and 2010. Remarkable gains in education, especially among women, are evident across younger cohorts. In 2010, a Chinese woman age 65 had on average less than half the years of schooling than a woman age 25-29 (3.85 versus 8.8 years of schooling); older Chinese men had just two-thirds the schooling of young men (six versus nine years of schooling).[8] Education in turn is strongly correlated with cognitive function at older ages: Lei et al. (2012 and 2014) analyze sex differences in cognition among older Chinese and show that education is by far the most important correlate of improvement over time in their cognitive skills.

For China, urbanization mechanically tends to reduce age-specific labor force participation at older ages, because Chinese farmers work well into their late 60s when they are able, hardly recognizing the term "retiree." But their labor productivity is quite low. By contrast, a better-educated, increasingly urban workforce has grown up after the scourges of malnutrition and disabling infectious disease have been mostly conquered. These young people may very well work longer, enjoying lower rates of disability and morbidity into their late 60s and even 70s. However, increased demand for leisure and "diseases of affluence" push the other way. Which forces will predominate in the coming decades in China? The next section considers whether China is experiencing healthy aging, or whether longer lives portend more years spent in poor and frail health.

Table 3
Educational Attainment in China, by Selected Age Groups, 1950, 1980 and 2010

Year	Age Group	MEN: Average Years of Schooling	WOMEN: Average Years of Schooling
1950	25-29	2.68	0.57
1950	50-54	0.24	0.03
1950	55-59	0.17	0.02
1950	60-64	0.12	0.02
1950	65-69	0.09	0.01
1950	15+	2.05	1.09
1980	25-29	6.33	5.21
1980	50-54	3.97	2.21
1980	55-59	2.74	0.57
1980	60-64	1.73	0.17
1980	65-69	1.20	0.10
1980	15+	5.50	4.16
2010	25-29	8.95	8.80
2010	50-54	7.90	6.83
2010	55-59	6.80	5.18
2010	60-64	6.80	5.18
2010	65-69	6.02	3.85
2010	15+	8.01	7.13

Source: Barro R. & J.W. Lee education dataset, June 2014 v2.0, available at *http://www.barrolee.com/*.

IV. Healthy Aging, or Older and Sicker?

Many researchers have been interested in understanding whether decreases in morbidity and disability have followed decreases in mortality, so that ill health is "compressed" into the last stage of life (Fries 1980). Some encouraging recent evidence for the U.S. comes from Cutler, Ghosh and Landrum (2013), who show compression of morbidity into a shorter period of time just before death, although disturbing trends of obesity may lead to stagnation or reversal in the future. For China, research is still needed, and is greatly facilitated by recent collection of detailed data in the CHARLS. According to the 2011 national baseline data, the elderly (age 60 and older) face many

health challenges: 10.7 percent were underweight; 28.0 percent were overweight (and 4.5 percent were obese by WHO standards); 31.8 percent reported having poor health; 38.1 percent reported a disability, defined as having difficulty completing basic daily activities on their own; 23.8 percent reported requiring assistance with basic daily activities; 33.4 percent experienced bodily pain; and 54.0 percent had hypertension, with a large minority undiagnosed and untreated (CHARLS Team 2013).

IV.i Epidemiologic Transition and the Burden of Chronic Disease

The nature of disease in China has changed from a primary burden of infectious disease to a disease burden dominated by chronic, non-communicable diseases such as cancer, heart disease and diabetes, but with important lingering problems from endemic and re-emerging infectious diseases such as hepatitis (a primary cause of liver cancer) and multidrug-resistant tuberculosis. According to official statistics, the leading cause of death in rural areas in 1990 was respiratory disease for both males and females, with heart diseases only No. 4, and tuberculosis and other infectious diseases within the top 10 causes. By 2011, the leading causes of death in rural China were cancer, cerebrovascular disease and heart disease, with tuberculosis and other infectious diseases no longer among the top 10 causes of death. In 2011, these top three chronic diseases accounted for 69 percent of urban deaths and 65 percent of rural deaths.

Several factors contribute to the relative stagnation in health improvement in China's reform era, including the stress of economic reforms that destroyed China's infamous "iron rice bowl" employment system; the increase in environmental pollution and traffic accidents; the continuing high prevalence of smoking among Chinese men; and the reduction in work-related exercise combined with more affluent and unhealthy diets.

In "The Macroeconomic Impact of Non-communicable Diseases in China and India: Estimates, Projections, and Comparisons," David E. Bloom and co-authors estimate that the cost of the five main "non-communicable diseases"—cardiovascular disease, cancer, chronic respiratory disease, diabetes and mental health—will total

about $23 trillion for China and $4.6 trillion for India (in 2010 U.S. dollars; Bloom et al. 2014). Their analyses also reveal that the large disparity in costs between the two countries arises primarily because of "China's higher and steeper income trajectory, and to a lesser extent its older population" (Bloom et al. 2014, p.1). The projections for the 2012-30 period are based on a standard Solow economic growth model augmented to incorporate health effects via two channels: mortality effects on labor supply, and diversion of savings from productive capital formation into unproductive healthcare spending. Additional effects from decrements to quality of life or the resource costs of effective programs to reduce risk factors (such as stopping smoking, reducing obesity and effectively managing blood pressure across the lifespan) would further increase the estimated macroeconomic burden.

In a sense, this shift in the burden of disease represents a natural progression of economic development and a triumph of earlier efforts to control infectious disease. However, the shift also places some constraints on China's future economic and social development—challenging economic growth to continue without the benefit of a "demographic dividend" from a large bulge in the working-age population; challenging the health system to better identify and manage chronic disease; and challenging communities and authorities beyond the health sector to address the broader social determinants of health, from clean air and water to tobacco control and active rather than sedentary lifestyles as China rapidly urbanizes.

IV.ii A Cautionary Tale from Japan

Contemporary Japan is a clear example of a "super aging society," and projections of its future demography carry sobering lessons. While Japan's sharp rise in the old age dependency ratio has been offset somewhat by high labor force participation among elderly compared to many other OECD countries, it remains questionable whether Japan can sustain a huge projected burden of social security and health expenditure (Ichimura, Shimizutani and Hashimoto 2009). Among OECD countries, only in Israel and Japan has health

spending growth accelerated rather than declined since the financial crisis of 2009, and population aging is one important reason. Japan's ratio of health spending to GDP has grown such that by 2010 it exceeded the OECD average for the first time.

According to a recent U.S. National Research Council report, compression of morbidity suggests that older individuals will be active longer and that there would be "very little change in the proportion of the population age 20-74 that could hypothetically supply labor between 2010 and 2050. Individual decisions and public policies may lead to a flat age at retirement in coming decades, but this will not be dictated by health and biology" (Lee 2014). It is far less clear that such a sanguine forecast could be made for Japan, given the projections of health and disability.

Recently, colleagues and I estimated a preliminary "Future Elderly Model" for Japan (Chen, Jalal et al. 2014).[9] Our simulation suggests that by 2040, more than 35 percent of Japan's population ages 50 and older will exhibit three or more limitations in instrumental activities of daily living and social functioning; about one in three will experience difficulties with three or more basic activities of daily living; and more than one in four will suffer limitations in cognitive or intellectual functioning. Even if these projections may represent an overestimate of disability in the later years, they nevertheless suggest a disturbingly high future burden of disability in Japan. Since the majority of the increase in disability arises from greater survival to older ages, prevention efforts that reduce age-specific disability (or future compression of morbidity among middle-aged Japanese) may have only a limited impact on reducing the overall prevalence of disability among Japanese elderly.

While no such model has yet been estimated for China, Zhang et al. (2014) use data from the 2006 Second China Sample Survey on Disability to estimate that the number of Chinese with disabilities will more than triple by 2050, with an annual increase of about 2 million over the next decades.

V. Demographic Change Beyond Aging: Gender Imbalance

We tend to think of demographic change as a process that shapes the choice set for economic policy and households. But macroeconomic forces can also powerfully shape demography, even over relatively short periods. Probably the most potent example is the large gender imbalance in specific regions of China and India, where son preference has interacted with fertility decline and "returns" to sons versus daughters to distort the sex ratio of the young population.

The sex ratio at birth in China has favored boys for two decades and continues unabated. Table 4 shows data on the sex ratio at birth—the number of boys born per 100 girls—between 2000 and 2010. According to the 2010 census, 118.06 boys are born for every 100 girls born in China. The excess of boys to girls in China is much higher in rural than urban areas. Already above normal by 1982, the sex ratio at birth has increased, enabled by sex-selective abortion (although it is illegal).

Such a large gender imbalance in a rapidly aging and urbanizing population is unprecedented, and its impact uncertain (Eggleston et al. 2013). Even if the recent easing of family planning policy restores the sex ratio at birth to normal levels within a few years, the existing imbalance among youth will create 20 million to 30 million "forced bachelors" among poor rural men, according to estimates by experts (Peng 2011; Li 2014).

Gender imbalance is an issue in India as well, and like for China, evidence suggests that households do respond to economic forces. For example, Anukriti and Kumler (2014) study how trade liberalization impacts fertility and sex ratios in India, using the natural experiment of the dramatic liberalization of trade policy after India's balance of payments crisis in August 1991. Using an empirical strategy comparing fertility and child health outcomes for women and births in districts differentially exposed to these unexpected tariff cuts, they find that trade liberalization did impact "returns to girls" and the sex ratio in India. In particular, Anukriti and Kumler (2014) find that greater exposure to tariff cuts increased employment for lower-caste women (as well as upper-caste men), increasing the relative returns to females

Table 4
Gender Imbalance in China: Rural-Urban Differences in Sex Ratio at Birth, 2000-10

	Sex ratio at birth: Number of boys born per 100 girls		
	2000	2005	2010
Cities	114.2	115.2	114.1
Towns	119.9	119.9	118.6
Rural areas	121.7	122.9	119.1

Sources: China Population Censuses in 2000 and 2010; 1 percent population sample survey in 2005, as cited in Li Shuzhuo, "Fertility, Sex Ratio, and Family Planning Policies in China," Keynote speech at China urbanization conference at Stanford Center at Peking University, May 25, 2014.

among lower-caste families. In turn, tariff cuts were associated with a less biased sex ratio at birth, lower child mortality and higher fertility among uneducated, low-wealth and lower-caste mothers. They found mirror image effects for high-caste mothers' fertility and sex ratio at birth.

VI. Demographic Challenges to Social Protection Policies

Estimates of consumption by age in China (Chen and Lee 2014; Cai et al. 2014) show a relatively constant level of consumption across generations in China, especially in rural areas. On one hand, this result could be considered a remarkable feat of intergenerational support: Even though the current elderly had much lower standards of living when they were working and limited opportunities for savings and investment, they are nevertheless sharing in the higher level of consumption that their children and grandchildren are now enjoying. On the other hand, relatively flat consumption by age could indicate a policy gap. In high-income countries, consumption by age is (steeply) increasing at older ages, driven by large healthcare expenditures. The consumption profile by age in China and India, especially in rural areas, suggests that many older adults may be foregoing the kind of medical care that those in higher-income countries regularly consume.

Indeed, the National Transfer Account estimates of medical spending by age in China show a dramatic change between the 1995 and 2009 period (Chen and Lee 2014; Chen, Eggleston and Li 2012). In 1995, medical spending of the elderly was not much different from

that of the working-age population. By 2009, medical spending was substantially higher for the elderly than for the middle-aged, similar to the pattern seen in high-income countries.

This dramatic change was enabled by the introduction of government-subsidized health insurance programs, especially the New Rural Cooperative Medical Scheme (NCMS) since 2002. Although benefits remain relatively low, China's virtually universal health coverage enabled by NCMS is an important achievement. Such an investment in access to basic medical care for all can improve survival and capability to work, and may help to increase labor force participation alongside healthy aging.

However, China also needs to get better value for money, and put health spending on a sustainable trajectory. Compared to pensions, health systems are more profoundly impacted by interaction of longevity with technological change. Costly new medical treatments can often bring great value, but patients do not bear their cost, so constraining spending growth without forfeiting life-saving innovation presents a significant policy conundrum.

Other social policies also require reforms. For example, the rural elderly will need greater old-age support. The pension system for rural residents, introduced in 2009, is another landmark achievement; but it only pays *3 percent* of the benefits paid to urban pensioners (Lu, He and Piggott 2014). For rural Chinese ages 60 and older in 2011, the poverty rate based only on the income of respondents and spouses (including pensions) was 65 percent, according to CHARLS data (CHARLS Team 2013). The poverty rate falls to 40 percent with intrahousehold support from co-residence and private transfers. Savings reduce poverty by a further 8 percentage points, and public transfers by a further, meager 3.3 percentage points (CHARLS Team 2013).

With smaller families and many adult children migrating to cities, co-residence as a source of old-age support is declining. One solution would be a noncontributory social pension—which Lu, He and Piggott (2014) calculate could eliminate elderly poverty with only about 1 percent of GDP for the next few decades. The proposal assumes the retirement age would increase in the future, to avoid undermining work incentives.

Improvement in pensions—such as the New Rural Pension System rolled out since 2009, and the recent announcement of consolidation of rural and urban basic pension systems—can also trickle down to enhance the welfare of the middle-aged and younger generations. For example, in a recent study on the intergenerational impact of China's new rural pension program using a fuzzy regression discontinuity design, Eggleston, Sun and Zhan (2014) find that China's new rural pension program enhances confidence in healthcare access, and promotes migration of labor and off-farm employment of adult children. Pension-eligible elderly are more confident that they will be able to be hospitalized if recommended by a doctor, even though self-assessed health and health insurance coverage do not change at the pension-eligible age threshold. Chen, Eggleston and Sun (2014), using data from rural Guizhou and Shandong, also find that the new rural pensions enabled more adult children to migrate for work while providing support of elderly through purchase of services.

For urbanization to help fuel continued economic growth in China, it will be important to allow greater freedom of migration with extension of social benefits, such as access to urban schools for migrant workers' children, portable health insurance and affordable housing with room to accommodate multigeneration families.

Although policymakers should pay attention to fiscal sustainability, it is also important to emphasize these positive direct and indirect effects of strengthening social welfare. More robust health insurance, pensions, and long-term care not only can provide dignity at the end of life for a generation that has sacrificed much for China, but also can create positive economy-wide effects. The latter include:

- reducing precautionary savings, an important goal in light of China's extraordinarily high savings rate;
- removing the economic rationale for son preference as old-age support; and
- enabling the younger generation to migrate and urbanize—critical for educational investment and productivity gains, and thus for continued improvement in living standards.

Endnotes

[1]The most similar economy in this respect is Vietnam, the other country that avoided a "transformational recession" during reform from central planning to a market-based economy. India shares many similarities in terms of development as an emerging market, but of course never had Mao-style central planning or Communist Party monopoly of power.

[2]Data come from the Human Mortality Database, University of California, Berkeley, and Max Planck Institute for Demographic Research. Available at *www.mortality.org.*

[3]That the same is not necessarily true for Chinese women is related to son preference and gender imbalance, discussed in Section V.

[4]Many analysts in and of China's labor markets have found that employment statistics are more stable across time and comparable across groups than the measure of labor force participation including those actively seeking employment, although the latter would be preferable for estimating XLFP.

[5]A *hukou* is a Chinese residence permit, categorized as either urban or agricultural.

[6]In China, the gender earnings differential has been widening: controlling for observables like education and experience, Chinese "women used to earn around 8 percent less than men; by 2009, the gap had widened to around 23 percent" (Meng 2012, p.84).

[7]Combined with a rather low consumption level, these NTA estimates show a "lifecycle surplus" for China reflecting high savings. But this distinctive situation may change rapidly as China's population ages and consumption patterns change. Cai et al. (2014, p.15) estimate that "a modest increase in consumption level combined with the rapid population aging will erase China's lifecycle surplus by around 2035."

[8]The closing of the gender gap in average years of schooling suggests a strong amelioration, if not elimination, of discrimination against girls. A less sanguine, alternative hypothesis is that parents with strong son preference, who would shirk investments in daughters, are now choosing to have sons. In fact, this is also true, as discussed in the section on gender imbalance.

[9]This study adapts to the Japanese population the Future Elderly Model (FEM), a demographic and economic Markov microsimulation model that projects the health conditions and functional status of Japan's elderly population in order to estimate disability, health and need for long-term care. We develop the model based on the recently released multiple waves of the Japan Study of Aging and Retirement (JSTAR) survey, the Japanese version of the Health and Retirement Study-like family of internationally comparable surveys (Ichimura et al. 2009). Using detailed data on a panel of Japanese ages 50-75 starting in 2007, we tailor the health transition matrix of the FEM model to the Japanese context, estimate conditional mortality probabilities consistent with Japanese national vital statistics, and use a

state-transition Markov model to project trends in the disability and functioning of Japan's future elderly population.

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