Macroeconomic Implications of Aging in East Asia Pacific: Demography, Labor Markets and Productivity

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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<tr>
<td>EAP</td>
<td>East Asia Pacific Region</td>
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<tr>
<td>ECA</td>
<td>Europe Central Asia Region</td>
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<tr>
<td>EDR</td>
<td>Elderly Dependency Ratio</td>
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<td>ETS</td>
<td>Educational Testing Service</td>
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<td>EPL</td>
<td>Employment Protection Legislation</td>
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<td>EPR</td>
<td>Employment-to-Population Ratios</td>
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<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>GBD</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GCF</td>
<td>Gross Capital Formation</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>Hong Kong Special Administrative Region</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>IHME</td>
<td>Institute for Health Metrics and Evaluation</td>
</tr>
<tr>
<td>IIASA</td>
<td>International Institute for Applied Systems Analysis</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organization</td>
</tr>
<tr>
<td>LABORSTA</td>
<td>ILO Labour Statistics databases</td>
</tr>
<tr>
<td>LAC</td>
<td>Latin America and the Caribbean Region</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Lao People's Democratic Republic</td>
</tr>
<tr>
<td>LCH</td>
<td>Lifecycle Savings Hypothesis</td>
</tr>
<tr>
<td>LF</td>
<td>Labor Force</td>
</tr>
<tr>
<td>LFPR</td>
<td>Labor Force Participation Rate</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>PISA</td>
<td>Programme for International Student Assessment</td>
</tr>
<tr>
<td>$PPP</td>
<td>Purchasing Power Parity</td>
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<tr>
<td>SOE</td>
<td>State-Owned Enterprises</td>
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<tr>
<td>STEP</td>
<td>Skills Towards Employability and Productivity</td>
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<tr>
<td>TDR</td>
<td>Total Dependency Ratio</td>
</tr>
<tr>
<td>TFR</td>
<td>Total Fertility Rates</td>
</tr>
<tr>
<td>TFP</td>
<td>Total Factor Productivity</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>WDI</td>
<td>World Development Indicator</td>
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<tr>
<td>WPP</td>
<td>Water Partnership Program</td>
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<tr>
<td>YDR</td>
<td>Youth Dependency Ratio</td>
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1. The Dividends of Age

1.1 The East Asia and Pacific region grew at an unparalleled rate in the past 50 years (See Figure 2). Over this period the region experienced some of the fastest economic growth rates in history. Between 1980 and 2010 China multiplied its per capita income by a factor of 13.6 in just 3 decades. GDP per capita in both Hong Kong SAR and Cambodia tripled between 1982 and 2012. Yet, major income differences persist between the richest, middle and lower income economies in the region. In 2012, China’s GDP per capita was still less than half the level of Japan’s in 1982 and Cambodia’s was less than a twentieth of Hong Kong’s.

1.2 This economic boom is partly attributable to unprecedented demographic changes in East Asia during this period. The substantial economic growth experienced from the 1960s to the 1990s is partly a result of favorable demographics, particularly the plummeting of youth dependency ratios in some countries during this period. These demographic changes in East Asia were the most dramatic the world has ever seen. Declining fertility and mortality rates and the subsequent increase in the working age population fueled a period of economic growth known as the demographic dividend. Several papers estimate that this dividend accounts for around one third, or up to 40 percent of East Asia’s tremendous economic growth over the period. (Bloom and Williamson, 1998; Bloom, Canning, and Malaney, 2000; Bloom, Canning, and Finlay, 2010; Kelley and Schmidt, 2005). This growth is all the more noteworthy because some of the younger East Asian and Pacific populations have yet to experience this demographic transition and the full extent of the economic benefits which may ensue.

Figure 1: The East Asia and Pacific region grew at an impressive rate in the past 50 years

(Growth of GDP in the last five decades)

Source: World Bank staff estimates using World Development Indicators, 2014
1.3 But demographics are only part of the story. The impact of population aging on GDP per capita also depends on labor force participation and productivity, which in turn are affected by demographic forces. Figure 2 decomposes the channels through which aging influences per capita income and provides the framework for this report: GDP per capita is reorganized as the product of the employment rate, the working age share of the population and GDP per employed worker (See Box 1). It is the confluence of demographic, employment and productivity factors that determines how aging has and will impact income per capita. Specifically, how the changing population age distribution, measured as the working age share of the population, affects income per capita depends on participation rates and the productivity of workers at each age. Moreover, labor participation rates and productivity at each age are themselves affected by the two drivers of aging, lower fertility and extended longevity, through impacts on economic behaviors and on physical and human capital accumulation. From a public policy perspective, demographics may be a given\(^1\), but labor participation and productivity are not. The size of the economic bonus or burden which results from population aging depends on how policy influences labor force participation, savings, human capital accumulation and total factor productivity.

**Figure 2: Breakdown of GDP per capita into the product of the employment rate, the working age share of the population, and GDP per employed worker**

(GDP, number of employed persons, and number of working age persons)

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<tbody>
<tr>
<td>Singapore</td>
<td>53,160</td>
<td>73%</td>
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</tr>
<tr>
<td>Hong Kong</td>
<td>42,356</td>
<td>67%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>31,409</td>
<td>67%</td>
<td>72%</td>
<td>75%</td>
</tr>
<tr>
<td>Korea, Rep.</td>
<td>26,830</td>
<td>67%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>13,793</td>
<td>61%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>7,082</td>
<td>81%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>6,692</td>
<td>76%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,864</td>
<td>68%</td>
<td></td>
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</tr>
<tr>
<td>Mongolia</td>
<td>1,686</td>
<td>60%</td>
<td></td>
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</tr>
<tr>
<td>Philippines</td>
<td>3,532</td>
<td>64%</td>
<td></td>
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</tr>
<tr>
<td>Vietnam</td>
<td>2,920</td>
<td>82%</td>
<td></td>
<td></td>
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<tr>
<td>Lao PDR</td>
<td>2,189</td>
<td>81%</td>
<td></td>
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<tr>
<td>PNG</td>
<td>2,187</td>
<td>74%</td>
<td>58%</td>
<td>4,525</td>
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<tr>
<td>Cambodia</td>
<td>1,949</td>
<td>88%</td>
<td></td>
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<tr>
<td>Timor-Leste</td>
<td>1,482</td>
<td>39%</td>
<td>50%</td>
<td>69%</td>
</tr>
<tr>
<td>Myanmar</td>
<td>(missing data)</td>
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</table>


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\(^1\) China may be the only country that has implemented a population policy that significantly affected its demographic processes.
Box 1: The economic effects of population aging work through three channels: population age structure, labor productivity and participation.

Demographics. Declines in mortality and fertility drive population aging. As these rates level off after the demographic transition, the relative share of the working age population increases and there are more working age adults for every young and old dependent. While this large working age group grows older, longevity also increases, and combines with already low fertility rates to produce a large share of elderly in the population. Both of these changes affect the number of individuals who can produce as a share of the total population and so mechanically affect GDP per capita.

Labor participation. The supply of labor depends on participation rates at each age, which determine the potential economic contribution of working age adults. Higher labor force participation rates among a growing group of working age individuals mean greater benefits will result from these favorable demographics. The propensity to participate by age and gender is itself shaped by demographic forces, as for example higher longevity raises the participation of the elderly, or lower fertility drives up women’s participation. But participation also depends on the incentives shaped by public policy. Therefore, when demographics are unfavorable, there is scope to encourage higher participation to compensate for negative demographic effects.

Labor productivity. The average value of an employed worker’s output explains the largest share of the difference in income per capita across countries in the region. Labor productivity interacts with aging in several ways. As the population ages, the net effect on GDP per capita is determined by labor productivity at each age. Evidence suggests that age and individual productivity are correlated, but the relation depends more on how much human and physical capital workers are equipped with. The current cohort of elderly in EAP is far more productive than was the previous cohort at any given age, particularly in countries where education and health have improved rapidly. More healthy and educated, the elderly are increasingly able to develop skills until later on. As people live and remain productive for longer, they will also save for longer, although the net impact on savings and capital is unclear.

Far from being deterministic, the effect of population aging on income and growth depends on workers’ participation and productivity.

1.4 These three factors together explain the variation in the size and timing of the demographic dividend in East Asia. First, the demographic factors related to fertility played a particularly important role. The region has the distinction of aging more quickly than any other region in human history: a rapid fall in fertility brought youth dependency to unprecedented lows and created a larger population bulge than was experienced anywhere else in the world. (Mason 2005). As a result, the demographic dividend is much longer and larger in East Asia than in other aging regions. East Asian countries have themselves had very different experiences with the demographic dividend due to variation in the speed and extent to which fertility plummeted across countries in the region. Youth dependency declined much more steeply in the high-income, aged countries – Japan and South Korea – resulting in a significant demographic dividend that has driven up their per capita incomes. The
middle income and aging countries – China, Thailand, Vietnam, and Malaysia - have also benefited from a significant demographic boon, albeit more recently. Finally, the expected decline in youth dependency among the younger populations in countries such as Timor-Leste and the Philippines provides a window of opportunity in the coming decades. Nonetheless, the potential to benefit from a comparable demographic dividend may not be realized to the extent it was in other countries in the region. The dependency rates in these countries will not fall as low as they did in the richer countries because the declines in mortality and fertility rates have been less dramatic and the period between these declines briefer.

1.5 Second, differences in labor productivity are responsible for a large share of the variation in the demographic dividend. In Figure 2 the East Asian countries are ranked in decreasing order of their GDP per capita in 2010 using data for GDP per capita in 2005 PPP terms, which map strikingly well to differences in labor productivity. Growth accounting confirms that very high rates of physical and human capital expansion in East Asia were the main driver of high growth in the past, compounding the advantages conferred by the population structure in countries such as Japan, South Korea, Singapore, Hong Kong SAR and China. (Young, 1995) While the demographic tailwind is fading out for those countries, there is scope for human capital and total factor productivity convergence to magnify the demographic dividend in countries like China, Malaysia, and Vietnam where youth dependency will continue declining, but labor productivity still lags far behind. This intensive growth potential is perhaps the most important in the decades to come in the group of younger countries, as their poorly educated and poorly equipped workforces grow substantially from the demographic transition.

1.6 The third factor is the rising labor force participation rates of certain groups, particularly women and migrant workers, in countries such as Japan, South Korea, Singapore and Malaysia. Rising labor force participation rates among women, who tend to be under-represented in the workforce, is particularly noteworthy. In some countries, such as Singapore, Hong Kong SAR and Malaysia, migration has played a disproportionate role in boosting total labor force participation rates. In the future, there is significant potential for further increases in participation rates among older workers, stimulated to work longer by improvements in longevity and educational attainment. However, such an expansion is not desirable and or likely in some of the less developed East Asian and Pacific countries, where mostly agrarian economies have high labor participation at all ages out of necessity rather than choice.

1.7 Looking ahead, the region’s younger countries will require economic conditions and policies that help them take full advantage of the demographic dividend. With fertility rates in the midst of their strong decline, countries such as the Philippines, Timor-Leste, PNG and Lao PDR will enjoy another 30 years of falling youth dependency. The economic gains of their growing workforces will depend on their physical and human capital. Policies will be required which allow markets to absorb the extra labor productively and which spur productivity by equipping the labor force with better
health\textsuperscript{2}, education, and capital. The supply of education is a case in point. With fewer children to care for, parents tend to invest more in the human capital of each of their children. The dramatic falls in fertility rates in these countries will give rise to impressive increases in education, as they did in the older countries in the region. As large cohorts of more educated children join the labor force in these younger countries, they can contribute to a substantial rise in economic growth. Yet this requires substantial investments to expand access to and increase the quality of their education systems and to improve child nutrition and health.

1.8 Two critical questions for the rest of the region are: First, as countries must progressively rely on smaller and older labor forces, will the sizable demographic dividend be followed by an equivalently considerable penalty on economic performance? Second, what broad strategies can be pursued to avert this potential negative impact, and how much of a difference can these strategies make to future income per capita growth? The key to answering these questions lies beyond pure demographics, in whether changes to labor force participation and productivity will offset the negative effects implied by simple growth accounting. (Bloom, Canning, and Finlay 2010)

1.9 There are three broad reasons for optimism, each of which will be explored in more detail in subsequent chapters. First, the story of rising dependency ratios is complex and not all bad. While total dependency ratios have or will soon begin to rise in almost all countries driven by rising elderly dependency, youth dependency will continue falling in some countries such as Vietnam, Indonesia and Mongolia, and to a lesser extent China and Thailand. Rising elderly dependency ratios and rising youth dependency ratios have very different economic implications. As will be examined in Chapter 2, while both children and the elderly tend to consume more than they produce, children below 15 cannot and should not be counted on to produce. In contrast, the elderly are increasingly able and choosing to produce until beyond 60 years old. Hence, from an economic standpoint the decline in productive capacity implied by a rise in elderly dependency is unlikely to mirror in magnitude the dividend which resulted from a fall in youth dependency. This is supported by current empirical evidence which indicates that aging has not had a significant impact on growth. Bloom, Canning and Finlay (2013) estimated the effect of aging on economic growth in East Asia and found that while a higher share of children affects growth negatively, the share of elderly has no significant impact on long run per capita income growth. Moreover, evidence suggests that age-specific behaviors with respect to labor, savings and human capital acquisition are shifting, so that an elderly person today resembles a younger person from an earlier cohort. Nonetheless, there is cause for being cautious because only short spans of time-series data are available to measure the potential costs of an aged population. Even Japan, regarded as a “super-aged” country, encountered a declining labor force trend relatively recently, in 2000. Moreover, the absence of evidence that more elderly can dampen growth may simply be due to the fact that the population bulge has not yet reached the age of 75-80 in any country in the region, not even in Japan.

\textsuperscript{2} For the effects of health on individual productivity, see Strauss and Thomas (1998) for a survey of the literature to date and Schultz (2002), Bleakley (2003, 2007), Behrman and Rosenzweig (2004), and Miguel and Kremer (2004) for more recent research.
1.10 **Second, encouraging participation rates is an important potential source of additional labor supply.** The decline in fertility frees up women’s time, allowing them to increase their participation in the formal economy. (Bloom, Canning, Fink and Finlay 2009). Evidence from EAP also shows that within countries participation in the labor force varies substantially across various subpopulations such as migrants, youth, women, and older people leaving room for convergence. Chapter 3 will explore the potential for stimulating participation and how this can countervail the aging effect on the supply of labor.

1.11 **Third, human capital investments are expected to grow enormously in the region, triggering higher rates of labor participation across all ages and across genders and accompanied by higher savings and productivity.** With fewer children to care for, parents tend to invest more in the human capital of each of their children. As cohorts of more educated children join the labor force, they are more productive than their less-educated parents were and can therefore each contribute to greater output growth. Similarly, as mortality rates decline at all ages, people live longer, healthier lives. This rise in life expectancy may entail an increase in savings and in human capital investments, which could even trigger a “second demographic dividend” (Mason and Lee, 2006). These questions of human capital and savings and their implications for how labor productivity relates to age will be explored in Chapter 4.

1.12 **Nonetheless, convergence in income per capita to the levels of Japan and South Korea remains a major challenge for lower income countries.** Chapter 5 brings the demographic, labor, and productivity channels together to explore base-case and best case scenarios of aging using two illustrative case-studies, Japan and Indonesia. These scenarios bring into sharp focus the divergence in paths which lower-middle income countries are taking relative to the older, richer countries in the region. While growth prospects appear resilient to aging even in the worst case scenarios, these countries are aging at much lower productivity levels and at a much faster pace than their older neighbors did. These countries are likely to face not just the challenge of catching up in per capita income but also achieving middle-income status with shares of elderly currently seen in high income countries. For example, in the best-case scenario for Indonesia, the effects of population aging on growth are positive; yet by 2040 Indonesians will only have the GDP per capita which Koreans enjoyed in 1985, but with as many dependents per worker as Korea in 2000. Indonesia and other countries in this low to middle income group will have to consider the prospect of middle income status with high rates of elderly individuals to support. This prospect suggests that these countries should plan for the challenge of sustainable and adequate support for dependent populations at lower levels of income.

2. The Demographics of an Aging East Asia Pacific

**What is population aging?**

2.1 **Measuring a population’s age by the share of its members who are 65 years old and above is intuitive.** More older people (relative to younger people) means more total years of life lived, consistent with the common understanding of age. While the age 65 (or 60) cutoff for old age is somewhat arbitrary, the same idea can be conveyed without an arbitrary cutoff by using the age at
which 50 percent of the population is younger and 50 percent of the population is older. When this median age increases, a population is said to be aging. These two measures of population aging are straightforward to implement and comport with generally accepted ideas about age.

2.2 However, chronological age has several shortcomings which are often overlooked. First, the share of individuals ages 65 and older can decrease, which means that populations, unlike individuals, can become younger. Using chronological age can thus lead to the false impression that population aging is ubiquitous and inevitable, neither of which is true. But populations can become younger in a second way, as Warren C. Sanderson and Sergei Scherbov laid out in a 2005 article in *Nature*.

(Sanderson and Scherbov 2005) Using chronological age alone requires ignoring a second important component of age: the number of years a person has left to live. Spijker and MacInnes (2013) point out that in England and Wales in 1900 the life expectancy at the median age of 24 was 39 years. By 2009, the life expectancy at the median age of 40 was 42 years. This means that “the population of 2009, despite being much older as measured by years lived, was nevertheless younger than that of 1900 in terms of years left.” (Spijker and MacInnes 2013 at p.1) Using only years lived would completely ignore the improvements in life expectancy between 1900 and 2009. Further, the relationship between many matters that people care about – from health care to human capital – and remaining life expectancy makes incorporating years of life left into a measure of age even more compelling. (Sanderson and Scherbov 2005; Spijker and MacInnes 2013)

2.3 Both chronological age and measures which take years of life left into account are important for understanding the impacts of population aging. However, chronological age should not be mistaken for an economic concept: while shares of the population above a certain age or population median ages can provide a sense for how a population is distributed, deeper analysis of the relationship between years of life lived and years of life left is required to understand what age means for work, leisure, and dependency.

Aging in East Asia Pacific

2.4 The East Asia and Pacific region is young compared to North America and Europe and Central Asia. In 2010, around 14 percent of the populations of North America and Europe and Central Asia were aged 65 and older (Figure 3). East Asia’s older population represented just half that much at an average of 7 percent of each country’s total population. At present, the region’s 65+ population share is similar to that of Latin America and the Caribbean (8 percent) and greater than that of South Asia and the Middle East and North Africa (5 percent). Sub-Saharan Africa is the youngest region with an average of just 3 percent of each country’s population composed of individuals aged 65 and older. This regional age hierarchy holds when shares of the total regional population are used instead of cross-country averages: Europe and Central Asia and North America

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3 For the purposes of this report, East Asia includes Cambodia; China; China, Hong Kong SAR; Indonesia; Japan; Lao People’s Democratic Republic; Malaysia; Mongolia; Myanmar; Papua New Guinea; the Philippines; Republic of Korea; Singapore; Thailand; Timor-Leste; and Vietnam.
lead the way with the 65+ population representing 15 percent and 13 percent of their total regional populations, respectively, while 8 percent of East Asia’s population and 7 percent of Latin America and the Caribbean’s population are 65 or older (Figure 4). Sub-Saharan Africa remains the youngest at 3 percent of the regional population.
Figure 3: East Asia is younger than North America and Europe and Central Asia whether using cross-country averages...
(Cross-country average of the total population aged 65 and older in 2010)

Source: World Bank staff estimates based on WPP 2012 revision
Note: Other East Asia & Pacific includes American Samoa; Australia; Brunei Darussalam; China, Macao SAR; Democratic People’s Republic of Korea; Fiji; French Polynesia; Guam; Kiribati; Marshall Islands; Federal States of Micronesia; New Caledonia; New Zealand; Northern Mariana Islands; Palau; Samoa; Solomon Islands; Tonga; Tuvalu; and Vanuatu.

Figure 4: …or share of regional population totals
(Percentage of the total population that was aged 65 and older in 2010)

Source: World Bank staff estimates based on WPP 2012 revision

Figure 5: Sub-Saharan Africa is the youngest region
(Percentage of the total population that was aged 65 and older in 2010)

Source: World Bank staff estimates based on WPP 2012 revision
2.5 Though East Asia’s 65-plus population is somewhat small compared to its total population, the aggregate number of old people in East Asia is staggering. The 16 countries of the region which we focus on contain 182 million individuals who are 65 and older, representing 35 percent of the global population in this age group (Figure 6). This means that almost four in ten of the world’s older individuals are found in East Asia. China is responsible for the vast majority of this old-age population with nearly 114 million people 65 and older. China alone would be third among global regions ranked by the number of elderly individuals.

![Figure 6: East Asia, led by China, has more older individuals than any other region](Number of individuals aged 65 and older in 2010)

Source: World Bank staff estimates based on WPP 2012 revision

2.6 East Asia is also notable for the speed of its aging. The region is aging more quickly than any other in human history. The population aged 65 and over in many countries in the region will increase from 7 percent to 14 percent of the total population in just two or three decades, a change that took 45 years in the United Kingdom, 69 years in the United States, and 115 years in France (Figure 7). (Kinsella and He, 2009) Five-year growth rates of the 65+ population in East Asia have been larger than those in North America and Europe and Central Asia in each 20-year period from 1955 to 2055 (Figure 5). Between 2015 and 2034, five-year growth rates will average 22 percent in East Asia, second only to the Middle East and North Africa’s 28 percent growth. As a result, by 2060 the average share of the population of East Asia that is 65 and older (22 percent) will be similar to that of North America (24 percent) and Europe and Central Asia (26 percent) (Figure 9). Whereas in 2010 only one of the world’s twenty-five oldest countries by share of the population age 65 and older was in East Asia, by 2060 five are projected to be.

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4 Growth rates are also quite high in the Middle East and North Africa and in South Asia.
5 Japan was the oldest country in the world in 2010 with the 65+ population representing 23 percent of the total.
6 These are South Korea, Japan, and Hong Kong with 37 percent; Thailand with 33 percent; and Singapore with 32 percent.
Figure 7: East Asia countries are aging more quickly than any other in the past
(The line begins in the year in which a country’s 65+ population reached 7% of the population and
ends in the year in which that country’s 65+ population reached 14% of the population. The length of
this transition in years appears in parentheses.)

Figure 8: The growth rates of the 65+ population in East Asia has outpaced growth rates in North
America and Europe and Central Asia
(Average cross-country five-year growth rates of the 65+ population averaged over four periods)


Source: World Bank staff estimates based on WPP 2012 revision
2.7 The population of those aged 80 and above – the oldest old – will grow faster in East Asia than in any other region. In 2010, these “oldest old” individuals represented a very small portion of the population across all world regions (Figure 10). However, by 2060 in Europe and Central Asia, North America, East Asia, and Latin America and the Caribbean this group will represent an average of 7 percent or more of the total population. The average population older than 80 in East Asia will increase 6.2 percentage points between 2010 and 2060, more than any other region.

Source: World Bank staff estimates based on WPP 2012 revision
2.8 The median age of a population is an alternate way to show population aging, which does not rely on a predetermined, and somewhat arbitrary, cutoff for old age. Instead, the measure simply shows the age at which half the population is younger and half the population is older. Median age also confirms that East Asia is currently youthful compared to the world’s oldest regions but is aging quickly. The average median age in East Asian countries was 29 in 2010, compared to 38 in North America and 37 in Europe and Central Asia (Figure 11). But by 2060, East Asia will have the second-highest average median age of any region at 43 years old, just below Europe and Central Asia (45 years old) and just above every other region except the still-youthful Sub-Saharan Africa. Median age will increase by two or more decades in most EAP countries between 1960 and 2060 (}
2.9 Table 1). Figure 11: Median age also confirms that East Asia is currently young but aging quickly
(Median age in 1960, 2010, and 2060)

Source: World Bank staff estimates based on WPP 2012 revision
Table 1: The median age will increase by two or more decades in most EAP countries between 1960 and 2060
(Median age in 1960, 2010, and 2060)

<table>
<thead>
<tr>
<th>Country</th>
<th>1960</th>
<th>2010</th>
<th>2060</th>
<th>Change 1960-2060</th>
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<td>54</td>
<td>34</td>
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<tr>
<td>Japan</td>
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</tr>
<tr>
<td>China, Hong Kong SAR</td>
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<td>29</td>
</tr>
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<td>Singapore</td>
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<td>32</td>
</tr>
<tr>
<td>Viet Nam</td>
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<td>29</td>
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</tr>
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<td>Mongolia</td>
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<td>Timor-Leste</td>
<td>19</td>
<td>16</td>
<td>26</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: World Bank staff estimates based on WPP 2012 revision

2.10 **But aging in East Asia is not uniform.** While all countries in East Asia are aging, this process is at different stages and is proceeding at different paces in different countries. In fact, East Asia includes both several of the youngest countries in the world and several of the oldest. Papua New Guinea and Timor-Leste, with about 3 percent of their population 65 and older, are as young as Nigeria and Tanzania in Sub-Saharan Africa while Japan is the oldest country in the world and Hong Kong and Korea are about as old as the United States and Australia.

2.11 **Three groupings of countries emerge when looking at aging trends within East Asia.** Hong Kong, Japan, South Korea, and Singapore – the wealthiest countries in the region – are advanced in the aging process with the population 65 and older representing an average of 14 percent of these “Red” countries’ total population in 2010.
2.12  Figure 12). This group has already experienced rapid aging. China, Indonesia, Malaysia, Mongolia, Thailand, and Vietnam represent a second, middle group which is currently aging very quickly. An average of 6 percent of the total population of these “Orange” countries was 65 and older in 2010. The third and final group consists of Cambodia, Lao PDR, Myanmar, Papua New Guinea, the Philippines, and Timor-Leste. These countries are still quite young – an average of 4 percent of the population of these “Green” countries was 65 or older in 2010 – but will begin to age quite quickly in the near future. This grouping is also very clear among the population 80 and above: by 2060, this oldest old population will make up an average of 17 percent of the population in Red countries, 7 percent in Orange ones, and just 3 percent in Green countries (2.13 Figure 13).
Figure 12: Three distinct aging patterns are apparent among EAP countries
(Share of population aged 65 and older 1950-2100)

Source: World Bank staff estimates based on WPP 2012 revision

Figure 13: These aging patterns are also evident among the population aged 80 and above
(Share of population aged 80 and older 2010 and 2060)

Source: World Bank staff estimates based on WPP 2012 revision

2.14 Digging into the drivers of aging across the region can help explain why some countries have grown old sooner than others and can help reveal the likely economic consequences of aging. Aging is a complex phenomenon in East Asia. The region is youthful at present, but is set to age rapidly in the near future. Several countries such as Japan and South Korea are already “old”; others such as Cambodia and Lao PDR are young now but will face a rapidly growing proportion of old people very soon.
The demographic implications of fertility and mortality

The drivers of population aging

2.15 Population aging is the product of two phenomena: a decline in the fertility rate and an increase in life expectancy at older ages. Over time, variation in the size of age cohorts due to these two phenomena also affects population aging. (Bloom, Canning, and Finlay 2010) Low fertility rates increase the proportion of people aged 65 and over without immediately increasing the number of people aged 65 and over. The impact of low fertility rates thus has the somewhat curious effect of making a population older without increasing the number of old people. An increase in life expectancy at old ages, in contrast, results from a decrease in the mortality rates of individuals aged 65 and older. All else equal, when the rate at which older people die declines both the number and the proportion of individuals age 65 and older increase. Finally, past fertility and mortality rates affect the current age distribution of a population: these determine the size of current age cohorts and so can result in larger proportions of older people if past fertility and mortality rates were higher and past mortality rates lower than current ones.

2.16 Aging across East Asian countries is distinguished by the extent to which these different drivers of aging are at play. A decline in fertility has occurred unevenly across the region. The older East Asian countries are leading the way with extremely low total fertility rates (TFRs) averaging 1.28 children per woman (Figure 14) in 2010. While the younger countries in the region have also experienced significant declines in the total fertility rate, these countries have rates which are more than twice as high (3.45 children per woman) as those in the older countries. The Orange countries fall between these two extremes with an average total fertility rate of 1.93. In this intermediate group, in 2010 total fertility rates had fallen to 1.66 in China, 1.75 in Vietnam and 1.41 in Thailand. Fertility rates are projected to continue to decline in the youngest countries and to flatten in the middle ones. Notably, the UN projects the increase in fertility rates that began around the turn of the century in the oldest countries to continue.
2.17 The projected increase of the total fertility rate in the oldest East Asian countries reveals the importance of the assumptions involved in projecting future population (Box 2). In estimating future fertility rates for countries which have undergone the demographic transition, the UN draws on evidence from low-fertility countries which have experienced a recovery of fertility rates. (United Nations 2014) This implicitly assumes that the East Asian countries which have completed the demographic transition will also experience an increase in total fertility rates. However, as the UN itself recognizes, the recovery of total fertility rates from extremely low levels in the oldest countries in the region is far from certain.

2.18 Fertility rates have indeed increased somewhat in recent years in Japan, South Korea, Singapore, and Hong Kong. However, there are important reasons to doubt that this increase constitutes a lasting trend (See Box 2). First, there is evidence that the rise in fertility rates is simply the result of delayed marriage and childbearing: the fertility rate temporarily declines as marriage and childbearing are delayed but increases again once this process ends. The recent increase in the fertility rate in East Asia may simply be the second part of this process. Furthermore, gender norms in older East Asian countries continue to compel women to undertake household duties even as opportunities for economic participation have increased, at the expense of marriage and childbearing. Child- and family-friendly policies have become more common in the region, but have thus far been insufficient to create an environment that is friendly to both women’s participation in the labor market and to their participation in the home. Gender and workplace norms may then prevent or hinder a recovery of fertility rates in the region, which would imply an older East Asia than is currently projected by the UN. (Jones 2011; Komine 2014)

7 Throughout the rest of this chapter, Europe and Central Asia is used for comparison because population aging is already at an advanced stage in the region.
The population data, which is drawn from the 2012 Revision of the United Nations’ World Populations Prospects, involves three important uncertainties and assumptions. These uncertainties and assumptions should be kept in mind throughout the analysis, particularly when long-term – and thus highly speculative – projections are made about future population size.

First, historical fertility and life expectancy rates are estimated with error, introducing imprecision into accounts of current population figures. This means that even past fertility, mortality, and population data should be used with caution. In some cases, especially for developing countries, the UN must draw from a variety of sources to develop its estimates. Figure 15 is reproduced from the World Populations Prospects methodology and illustrates the highly variable data and highly variable data sources available to the UN for estimation of Niger’s total fertility rate. Second, UN projections of future population require nontrivial assumptions about fertility, mortality, and international migration. In response to this, the UN provides five different scenarios for the evolution of fertility rates, which range from low to high fertility. Additional assumptions are made about mortality rates, recognized in a sixth scenario which projects population if the mortality rates were to remain constant, and about migration, recognized in a seventh scenario which projects population if there were no migration. An eighth and final scenario projects population holding fertility and mortality constant.

While the UN invests significant effort into providing the best projections possible, the complexity of the endeavor is such that the projections can be considerably inaccurate (Figure 16).

Third, assumptions are made about working ages which have important economic implications. For example, dependency ratios, which provide a picture of how well a population is able to provide for those who cannot support themselves, depend on assumptions about the age at which individuals stop (and start) working. Dependents are considered to be individuals aged 0 to 14 and aged 65 and older, regardless of their labor market status. Those aged 15 to 64, in contrast, are considered to be non-
These uncertainties and assumptions mean that all population figures and projections should be treated with caution. The selection of fertility scenarios, for instance, affects the conclusions one makes about the evolution of population aging in East Asia. The report uses the medium fertility scenario throughout, but the high and low scenarios were also tested to ensure that conclusions are robust to these assumptions. For example, as shown in Figure 17, the division of East Asian countries into three typologies does not depend on the fertility scenario used through 2060. By 2060, though, the variation within the Red and Orange countries – that is, between the low and high fertility scenarios – is nearly as large as the variation across these two groups, illuminating the significant uncertainty about the projections further into the future.

Figure 17: The typology of East Asian countries is robust to the three UN fertility scenarios to 2060 (Share of population aged 65 and older)

Source: World Bank staff estimates based on WPP 2012 revision

2.19 The other driver of population aging – changes in age-specific mortality – is also at work in East Asia. The same three groups of East Asian countries exhibit distinct patterns of life expectancy (Figure 18). Life expectancy at age 60 has increased much more quickly in recent years in the oldest countries in the region and is currently much higher than that of their peers (the same is true for life expectancy at age 80). Average gains in life expectancy in the youngest countries have been much less dramatic, meaning that the gap between life expectancy at age 60 in the youngest and oldest countries is projected to grow from around 3 years in 1950 to 7 years in 2010 and 10 years by 2060. Interestingly, the reverse is true of the gap between life expectancy at birth between these two groups of countries: the gap is projected to narrow from 19 years in 1950 to 15 years in 2010 and 14 years by 2060. This is consistent with the youngest countries becoming younger via lower mortality rates at younger ages (resulting in more young people), while the oldest countries become older via extensions in life expectancy at the oldest ages.
2.20 In most countries in East Asia, the decline in fertility rates is driving population aging. (Bloom, Canning, and Finlay 2010) Fertility rates in the region declined dramatically between 1960 and 2005, falling from 5.91 to 2.46 children per woman. This compares with a decline in the global average from 5.51 to 3.03 children per woman. (Bloom, Canning, and Finlay 2010) In fact, the fertility rates in many East Asian countries are now among the lowest in the world. While life expectancy has also improved, the impact on aging in East Asia has been less dramatic. Bloom, Canning, and Finlay (2010) calculate that the proportion of individuals ages zero to five would have been seven percentage points higher in 2005 had fertility rates remained at 1960 levels rather than declining. This contrasts with a 0.1 percentage point decline in the same population had age-specific mortality rates remained at 1960 levels. (Bloom, Canning, and Finlay 2010) In the future, the low fertility and mortality rates which developed between 1960 and 2005 will continue to lead to population aging, as cohorts formed by these past rates move through the age distribution, even as the future rates themselves are projected to stabilize. (Bloom, Canning, and Finlay 2010)

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8 As explained in Bloom, Canning, and Finlay (2010), the decline in mortality rates across all ages is one explanation for the limited effect of the decline in mortality rates on population aging compared to that of the decline in fertility rates. (Bloom, Canning, and Finlay 2010)
### The demographic transition

#### 2.21 The decline in fertility and mortality rates are defining features of the demographic transition, a phenomenon which is crucial for understanding the evolution of the age structure of East Asia’s population. In the demographic transition, mortality rates first decline, particularly at young ages, which results in an increase in the population growth rate and a spike in the number of children compared to the working age population. Fertility rates then decline as households shift from having many children to having fewer children. As fertility rates decline, the number of young people declines relative to an already larger working age population (itself the product of the decline in mortality rates). Finally, as this larger working age population grows older, increasing longevity combines with already low fertility rates to produce a very large elderly population.

#### 2.22 Figure 15, which plots the age distribution East Asian countries in 1960, 2010, and 2060, shows the population bulge which results from the initial decline in mortality and the subsequent decline in fertility. Thailand is a particularly clear example. In 1960, the population was dominated by young people under the age of 15, while there were very few older people over the age of 64. In 2010, this youth bulge had moved within the bounds of the working age population: the red line exhibits a distinct “bulge” between ages 15 and 64 in 2010. By 2060, the bulge is evident on the right-hand side of the age distribution; the youth bulge has become an elderly bulge.

#### 2.23 The Red, Orange, and Green countries will experience the demographic transition at different points in time. The youth bulge is clearly apparent in the 2010 age distribution of the red countries in Figure 15, though in Japan the bulge appears to have occurred between 1960 and 2010 which is consistent with the country’s rapid aging in the second half of the twentieth century. The Orange countries present a less clear picture, with some such as Thailand and China exhibiting clear bulges in their working age populations in 2010 and others such as Indonesia and Mongolia exhibiting these bulges in 2060. The green countries are characterized by their lack of bulges in 2010; bulges only begin to appear in 2060 for these countries.
Figure 19: “Bulges” are apparent in the working age populations of red and Orange countries in 2010 and in green countries in 2060
(Age distribution of the population in 1960, 2010, and 2060)
2.24 As the youth bulge progresses through the age distribution, the number of individuals outside of the traditional bounds of the working age first decreases, then increases, and then decreases again relative to the number of working age individuals. Over the next thirty years, many Red and some Purple countries will enter the third phase of this process, while Green countries are still in the second stage. Figure 20 and
2.26 Figure 21 show the change in the total size of the working age population. While in relative terms China fares better than most other aging countries in the region (Figure 20), in absolute numbers China dwarfs all other countries with an expected loss of nearly 90 million people of working age. Many lower-income Green and some Purple countries with younger populations have yet to fully benefit from favorable age structures. In these young countries, the share of the working age population is not expected to shrink until after 2040. In absolute terms, the Philippines and Indonesia will account for a large share of the regional increase. In relative terms, Timor-Leste, Lao PDR, Papua New Guinea, the Philippines, and Cambodia will lead the way. Mongolia is an exception: it is expected neither to gain nor to lose in terms of its working age population.

Figure 20: The working age population will grow in younger countries both relatively…
(Expected relative change in working-age population, 15–64 Years, 2010-2040)

Source: World Bank staff estimates based on WPP 2012 revision
2.27 The total dependency ratio (TDR), which divides the number of individuals aged 0 to 14 plus the number of individuals 65 and above ("dependents") by the number of individuals aged 15 to 65 (the "working age" population), is a way of measuring the relative size of the working age population. Both the magnitude and the trend of the TDR are important for understanding a population’s changing age composition. The smaller the ratio, the larger the relative size of the working age population. A declining dependency ratio indicates that the relative size of the working age population is growing: there are more working age individuals for every dependent (i.e. younger and older person).

The three aging profiles of East Asian countries exhibit distinct patterns of total dependency ratios. In the youngest Green countries, total dependency ratios (TDRs) have been and are projected to continue to decline until 2045.
Figure 22). Total dependency ratios in the oldest Red countries, in contrast, have been increasing since 2010 and will continue to do so, reaching 94 dependents for every 100 working age individuals by 2060. The ratio is currently less than half that. While at present higher than the total dependency ratio of the red countries, the TDR is just beginning to increase in the Orange countries and will only reach 67 dependents for every 100 working age individuals by 2060.
Figure 22: The total dependency ratio is increasing in red and Orange countries, but still falling in green countries (Ratio of population 0-14 and 65+ to population 15 to 65)

Source: World Bank staff estimates based on WPP 2012 revision

2.28 The progression of the youth bulge through the age distribution results in a sustained decline in the dependency ratio. The size and duration of this decline vary across countries, suggesting that some countries are better positioned demographically to reap economic benefits as population aging proceeds. Figure 23 shows the beginning and end of this period for each East Asian group. The first bubble shows when the decline began (the TDR at its maximum) and is sized according to the magnitude of the dependency ratio at that date. The second bubble shows when the decline ended (the TDR at its minimum) and, again, is sized according to the magnitude of the dependency ratio at that date. The decline in the dependency ratio from the beginning to the end of the decline is shown as the difference in the size of the bubbles (or, simply, the difference in the percentages shown inside the bubbles). The Green countries will experience the longest period of decline, which will last 80 years compared to the Oranges’ 45 years and the Reds’ 50 years. However, the magnitude of the decline is greatest in the Orange countries where the ratio will fall from 90 percent to 43 percent. The magnitude is smaller in the red countries, where it will fall from 74 percent to 41 percent, and in the Green countries, where it will fall from 88 percent to 51 percent.
Figure 23: The total dependency ratio will decline over a longer period in the Green countries but this decline will be largest in the Orange countries
(Ratio of population 0-14 and 65+ to population 15 to 64)

Source: World Bank staff estimates based on WPP 2012 revision
Note: The first bubble in each group appears in the year in which the total dependency ratio begins to decline. The second bubble in each group appears in the year in which the total dependency ratio stops declining. The bubbles are sized by their total dependency ratio.

2.29 Though useful for providing a general sense of how skewed the population age distribution is, the total dependency ratio suffers from several drawbacks. First, the TDR lumps young and old populations together, which can obscure important changes within each of these groups. Indeed, the picture of dependency in East Asia is more nuanced when the TDR is broken into youth (0 to 14) and old age (65 plus) dependency ratios (
While one might interpret the high TDRs in Green and Orange countries in the second half of the twentieth century as problematic, these TDRs are in some sense a positive sign: they reflect high youth dependency in those years, which would ultimately result in a larger working age population and the demographic dividend occurring today. The story is different in the case of the Reds. In those countries, a flat TDR in the 1990s and early 2000s resulted from the combination of a youth dependency ratio that continued to decline but an elderly dependency ratio that began to increase. The Red countries thus face a turning demographic tide as their working age populations shrink relative to their young populations, which are still small due to low fertility rates, and to their elderly populations, which are newly large because the population bulge has now reached old age. The Orange countries will face a similar fate as early as 2020 as their elderly dependency ratios increase and their youth dependency ratios continue to decline.
Figure 24: Total dependency ratio can conceal important changes in youth and elderly population shares  
(Ratio of population 0-14, 65+, and their sum to the population 15 to 64)

Source: World Bank staff estimates based on WPP 2012 revision
Note: TDR is Total Dependency Ratio, EDR is Elderly Dependency Ratio, and YDR is Youth Dependency Ratio. TDR is equal to the sum of EDR and YDR.

2.31 Traditional dependency ratios are useful as a measure of age composition but are less useful as a measure of dependency. Even when young and old are separated and youth and elderly dependency ratios are calculated, the age cutoffs used in traditional dependency ratios are arbitrary, meaning that they are accurate reflections of proportions of young and old but less accurate reflections of who is dependent. The age cutoffs traditionally used do not allow for the possibility – the reality in many places – that individuals work well past age 60 or 65 and so would not in other contexts be considered to be “dependent.” More generally, the bounds of the working age population do not reflect changes in health, life expectancy, education, or incentives for early retirement.

2.32 This suggests the second drawback of total dependency ratios – and of traditional dependency ratios in general: they conflate age and dependency. The link between age and dependency is based on the lifecycle pattern of consumption and production. Young and old people both tend to consume more than they earn and so are considered dependent while “middle-aged” people tend to earn more than they consume and so are considered non-dependent.

2.33 Figure 25 illustrates this lifecycle pattern of consumption for Japan and Thailand using National Transfer Accounts. The figure shows that both the young and the old are net consumers.
Figure 25: The link between age and dependency is based on the lifecycle pattern of consumption
(Annual per capita flows in Japanese Yen and Thai Baht in 2004)

Source: Lee and Mason (2011)
Note: The vertical lines indicate the ages between which labor income is larger than consumption.

2.34 But the relationship between age and dependency is more nuanced than traditional dependency ratios assume. First, while both young people and old people consume more than they earn, the patterns of consumption between the two groups are not the same. In Thailand, for example, the youngest people consume approximately half of what individuals 15 and older consume. Second, the type of “dependence” implied by the consumption of young people is different from that implied by the consumption of older people. Young people’s consumption includes significant investment in human capital which has long-term (positive) implications for economic growth. (Prettner, Bloom, and Strulik 2013) The consumption of elderly individuals, in contrast, involves very little, if any, investment in human capital. Third, people do not become economically inactive just because they reach the age of 65. Longer life expectancy can lead to longer working lives. Older people can also participate in economic life by dissaving and by participating in household, volunteer, and other community activities. On the less optimistic side, individuals may drop out of the labor force well before age 65. As

2.35 Figure 25 shows, older individuals in Japan and Thailand become net consumers at age 60 and age 58, respectively. Finally, lifecycle patterns of consumption vary across countries (and likely within them), as this difference in age of net consumption demonstrates.

Box 2. Alternative measures of dependency

There have been many attempts to rethink and improve dependency ratios in order to make them more relevant to policymaking. (Sanderson and Scherbov 2007; Sanderson and Scherbov 2013; Spijker and MacInnes 2013) In a recent example, Spijker and MacInnes (2013) propose using 15 years or less of remaining life expectancy as a proxy for dependency, arguing that remaining life expectancy is closely linked to health and active behaviors in addition to being an important “second” component of age. The authors also propose the employed population as a more accurate indicator of who works than the broader working age population. The results are striking when this new old-age dependency ratio is applied to the United Kingdom and several other OECD countries. The traditional old age dependency ratio implies that there are now many fewer working age individuals for every
person aged 65 and over and that this trend will continue in the future. The Spijker and MacInnes (2013) measure, in contrast, finds that dependency fell in the past, will continue to fall in the near future, and will rise only gradually in the long term. As the authors put it, “over the past four decades the population, far from aging, has in fact been getting younger…” (Spijker and MacInnes 2013)

However, the brighter picture of aging presented in Spijker and MacInnes (2013) is itself problematic. While the alternative dependency ratio incorporates changes in education, female labor force participation, and early retirement, the measure still relies on an arbitrary cutoff for dependency, setting 15 years of remaining life expectancy as the threshold. Indeed, there is little or no empirical evidence that links this particular 15 years threshold to dependency. Another dependency ratio alternative makes additional progress in overcoming the arbitrary dependency cutoffs. This measure uses the lifecycle pattern of consumption described in National Transfer Accounts to directly compute the ratio of people weighted by age-specific earnings and age-specific labor force participation rates to people weighted by age-specific consumption. (Prskawetz and Sambt 2014) The results are opposite to those found in Spijker and MacInnes (2013): in the future, the alternative measure declines more (i.e. implies more dependency) than the traditional economic support ratio on which it is based, which divides the working age population by the overall population and uses arbitrary age cutoffs. (Prskawetz and Sambt 2014)

The contrasting results of Spijker and MacInnes (2013) and Prskawetz and Sambt (2014) illustrate that any measure of aging should be approached with caution and an open mind. But these two dependency ratio alternatives are both improvements on the traditional measure because they directly acknowledge that dependency ratios have policy implications: dependency is not only about demographic structure but about behavior which policy can influence. These refined dependency ratios suggest potential policy remedies – incentives to increase the labor force participation of older people, investments in health that are associated with lengthier working lives, adjustments to the age of pension eligibility – when policymakers consider dependency ratios to be “too high.” The traditional dependency ratio only portrays the extent to which a population is dominated by young and old individuals.

The Economic Implications of the Demographic Transition

The demographic dividend

2.36 The decline in the total dependency ratio due to the demographic transition spurs a rise in income per capita called the demographic dividend. This dividend consists of two effects: a direct mechanical effect of population age structure and an indirect effect which acts via economic behaviors. To illustrate this, the growth rate of GDP per person is broken into labor (worker per population) and productivity (GDP per worker) components, as in the framework introduced in Figure 2. Figure 26 below illustrates the demographic dividend using data for Korea from 1950 to 2010. During this period, and particularly from the 1970s to the 1990s, the population bulge created by the dramatic decline of mortality and fertility rates in the 1950s and 1960s resulted in faster growth in the working age population relative to the total population. As a consequence, average income per
person grew mechanically. The decomposition shows this direct effect on growth as the vertical distance between the growth rate of GDP per person and the growth rate of GDP per worker (also shown as the vertical green bars). Thus, even before taking into account any potential increase in productivity, the rise in the share of workers automatically increased the growth of average income per person.

2.37 The fall in fertility and the rise in life expectancy which increase the share of the working age population also have an impact on people’s behavior which can significantly amplify the mechanical effect of demographics. The behaviors which result in more productive capacity include higher participation rates, especially among women due to lower fertility rates, and more investment in children, which also results from lower fertility rates. As mortality rates decline at all ages people increase participation, save more for old age, and increase human capital investments because they expect a greater return on that investment. Figure 26 suggests that these indirect effects were at work in Korea in the second half of the twentieth century. The periods of growth in the working age share of the Korean population coincided with periods of high labor productivity growth, which was consistently above 4%. While the growth in productivity cannot be attributed entirely to the demographic dividend, the channels described above explain how the demographic transition can also spur productivity growth.

Figure 26: Demographic dividend in Korea (1950-2010)

2.38 This chapter has outlined the quick, but diverse, population aging of East Asian countries and described the economic opportunity presented by the demographic transition. East Asia is ageing more quickly than any other region in history. Countries in East Asia can be categorized based on their stage of population ageing and on the drivers of that ageing. Older, wealthier countries such as Japan have a relatively large proportion of the population which is age 65 and over, low fertility rates, longer life expectancies, stable youth dependency ratios, and quickly increasing elderly dependency ratios. Younger, poorer countries such as Lao PDR have a relatively small proportion of the population which is age 65 and over, higher fertility rates, lower life expectancies, declining youth
dependency ratios, and slowly increasing elderly dependency ratios. A sustained decline in the youth dependency ratio is a defining feature of population ageing. The longer and larger the decline, the better positioned a country is demographically to reap economic benefits. But the significant economic advantage conferred by this period of declining youth dependency is not inevitable. The incentives created by the policy environment play an important role in determining how these mechanical and behavioral forces translate into economic growth. The following two chapters will explore how two of these forces – labor and productivity – and the policies that impact each interact with demographics to affect economic growth. A key message of these chapters is that a policy environment which enables growth is crucial for exploiting the potential economic benefits of the demographic dividend and dampening the potential adverse effects of aging.

3. Aging and Labor Markets

**Portrait of Labor Supply in East Asia Pacific**

*Figure 27: Many large East Asian countries are entering an age with fewer workers (Labor supply from 1960-2010 in Orange countries; normalized to LF in 1990 = 1)*
3.1 **Concerns about aging populations per se are misleading without a clear sense of the extent of the impact on labor markets.** The macro-economic framework introduced earlier demonstrated how demographics link to economic growth via labor markets and, notably, that individual choices about work participation also play a role in determining economic performance. While demographic outcomes are shaped by longer term changes in fertility preferences and mortality, the participation rate is more malleable to shorter term changes in incentives and policy. Therefore, a careful examination of labor supply patterns provides a more complete and nuanced economic underpinning to concerns about aging. To that end, this chapter presents a portrait of regional labor supply, and examines in detail possible labor supply and demand factors which are likely to boost labor market participation and counteract the effects of population aging.

3.2 **Over the last thirty years the EAP region was marked by large numbers of working-age individuals boosting regional labor supply to unprecedented levels.** Figure 27 and
3.3 Figure 28 depict the varying paces at which labor supply expanded across the countries. Even in the short span since the 1990s, demographics has boosted the number of workers at a relatively quick pace with rates that ranged from a 53 percent increase in Vietnam to a 72 percent increase in Malaysia. Among other countries in the Orange group, notably China and Thailand, the expansion was more modest at 27 and 20 percent, respectively.

3.4 The rising labor supply benefited from dramatic changes to the age-structure and in some cases also from growing participation rates. Figure 29 compares (1) the change in the age-specific share of the population in 2010 and 1990 and (2) changes to labor force participation in 1990 (or earlier as marked in the figure) and 2010. Countries such as South Korea, Japan, Singapore and Malaysia\(^9\) benefited from favorable demographics and rising participation rates. In other countries, increased labor supply was primarily driven by a growing share of prime working-age groups, most prominently in Vietnam, China and Thailand where the participation rates have historically been at higher levels. While the changes to the age structure associated with aging will lead to a shrinking share of the working age population, Figure 29 also confirms that within the working-age population, workforces are getting older. For example, in China the population shifted from a much younger workforce towards a population with a larger number of individuals aged 35-65 relative to the number of individuals aged 15-34. Given that participation rates decline at older ages, the dramatic shift from younger to older people is an additional factor which will further reduce rates of growth in labor supply. Such a shift towards an aging workforce is also evident in Vietnam, Korea, and Japan.

\footnote{Note that comparisons since 1960 for Japan and Korea; since 1990 are for Vietnam.}
3.5 Within the region and by 2010 total LFPRs rose significantly in Singapore, Korea, and Indonesia but dropped from their peak in China, Thailand, Vietnam, Japan, Lao PDR and Hong Kong SAR. The combined demographic effects and age-specific participation rates can be summarized in the total labor force participation rate (LFPR). Total LFPR is defined as the number of men and women active in the labor force divided by the total population aged 15 and older. This measure has a direct relationship with gross domestic product per capita, which measures economic
performance\textsuperscript{10}. Figure 30 presents the extent of differences in total LFPRs across the EAP countries in 2010 relative to 1990 (and 1960 and 1980 where data series are available). In terms of absolute rates of total LFPR, by 2010 Orange countries were marked by significantly higher total LFPRs than the Red group of countries. This can be explained chiefly by an aging workforce, higher personal incomes, and more advanced social security systems in Red countries which make it possible to retire earlier. In terms of time trends, total LFPRs rose significantly in Indonesia, Singapore, and Korea due to the combined effect of rising participation rates and increasing working-age populations since the 1970-80’s. But LFPRs in China, Thailand, Vietnam, Japan, and Lao PDR are already on a declining path primarily due to the demographic effect. Compared to 1990, there was only a slight improvement in Myanmar, Cambodia, and Mongolia.

**Figure 30: Total labor force participation rates vary significantly over time**

Total labor force participation rates (various years to 2010)

Source: World Bank staff estimates using WPP and LABORSTA.

3.6 There are important gender differences in trends that (1) demonstrate that average propensity for adjustment in participation rates varies enormously by gender and (2) suggest that rising participation has already counteracted the demographic effect in the past. Two lessons can be taken away from

\[ \frac{GDP}{P} = \frac{GDP}{LF_{15+}} \times \left( \text{total LFPR} \right) \times \frac{Pop_{15+}}{P} \]

\text{where P denotes total population size and LF is size of the labour force.}
3.7 Figure 31 and Figure 32. First, there is clearly a large gap in male and female participation levels which suggests potential for convergence towards higher participation among women. Second, the figures demonstrate the opposite ways men’s and women’s participation rates have been moving over time. For most countries in the region, total male LFPRs have declined sharply, with some countries such as Japan showing a decline close to 15 percentage points. In comparison, female total LFPRs have increased despite aging, which implies that in several countries such as South Korea, Malaysia and Singapore participation rates have been able to counteract the demographic effect on female labor supply. This is not the case in China and Japan, where age specific participation rates for women did not rise as much. Overall, this suggests that changing patterns in norms and incentives are shifting age specific participation rates depending on age and gender. Importantly, the growing participation among women indicates a relatively short term plasticity of preferences with regard to work. In sum, this evidence suggests that medium term convergence towards fuller utilization of the work participation potential is plausible.
Figure 31: Average total LFPRs conceal important differences in trends among subpopulations, including men…
(Total LFPR trends for men)


Figure 32: …for women
(Total LFPR trends for women; various years – 2010)


3.8 In sum, the demographic advantage that fueled regional labor supply in the past is in the process of reversal. This phenomenon is already underway in Japan, and numerous other countries including China, Thailand, and South Korea will experience a sharp decline in their working age
populations within a decade. The demographic projections raised a major concern about the prospect of significant contraction of labor supply. This raises two key questions regarding future participation rates. First, whether behavioral and policy changes are likely to lead to upward adjustment of participation rates as a response to the new demographic reality. And secondly, whether the increased participation, regardless of the mechanism that caused it, will make a significant difference in the labor markets. The answer to the first question depends in large part on trends in the factors which shape participation rates. This is especially true among groups which have tended to be underrepresented in the workforce, thus leaving potential for further growth. The following sections explore the major factors which are likely to shape participation: education, health, migration and the gap between the country specific participation rates for specific sub-populations. The second question is examined through simulations which estimate future labor supply trends under alternative participation scenarios.

Is there scope for higher participation?

3.9 There are multiple reasons for optimism as behavioral changes are likely to raise participation rates in the wake of lower fertility. When fertility rates are low two important behavioral changes towards work and human capital investments can result. First, fewer children per woman mean more time for caregivers, typically women, to work outside the household. Second, fewer children mean more time and resources that a given household can devote to each child’s care and education. Bloom et al. (2009) model the impact of fertility rates on female labor force participation and have shown that the impact of this expanded opportunity for female participation is substantial. The authors estimate that the demographic transition – which typically involves a decline of four births per woman – results in an increase in female labor force participation of 18 percentage points. In other words their cross-country estimates imply that with each birth there is a reduction of about four years of paid work over a woman’s lifetime or 5 to 10 percentage point increase in labor force participation.

3.10 Growing educational attainment is expected to play a major role in promoting higher participation among all ages and genders. Two main explanations underscore why educational trends presented below provide good reasons for optimism. First, higher educational attainment creates greater stimulus for better-paid employment. Second, studies find that more education is associated with better health outcomes, and lower mortality (Cutler and Lleras-Muney, 2008) thus improving the ability and willingness of older people to participate in the labor force (Burtless, 2013). According to this logic the regional education projections until 2040 imply that labor force participation, especially at middle and older ages, is expected to expand. The Vienna University of Economics and Business and the International Institute for Applied Systems Analysis (IIASA) estimated the rates of secondary and tertiary education attainment across the region since 1990. These estimates are presented in Table 2 and
Table 3 as multi-year estimates. Focusing on the top of the educational ladder, the tables demonstrate two broad educational trends for the future. First, each generation of future workers will be significantly more educated than the last. In Korea the share of the population with at least secondary education will rise to 100 percent; by 2030 in China and Philippines the share will soared to over 80 percent from around 50 percent in 1990. The most remarkable jumps are expected to occur in Indonesia, where the rate will rise from 30 percent in 1990 to 70 percent in 2030 and in Vietnam, where the rate will rise from 24 percent to 49 percent. China’s trajectory of educational attainment is especially important with enormous implications for the region due to the size of its population. According to the IIASA, the share of the population with secondary or tertiary education in China will rise by 35 percentage points by 2040. The second broad trend implies that the educational gap between older and younger workers is expected to diminish considerably in Malaysia, Thailand, China, Indonesia, and the Philippines, and even disappear in some countries such as Korea. While productivity differences may persist due to age-specific factors, it is reassuring that inequality of education is going to diminish significantly. This implies improving prospects for employment at older ages. Overall, as long as an increasing share of the population is better educated, and successive cohorts supplant the less educated generations, labor participation rates are expected to grow, especially among the older population for whom the participation rate tends to be lower.

Table 2: Regional education trends in secondary education imply that labor force participation is expected to expand
(Share of population 20-64 years old with secondary or higher education in 1990, 2030 and 2040)

<table>
<thead>
<tr>
<th>Country</th>
<th>1990</th>
<th>2030</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong SAR</td>
<td>72.5</td>
<td>89.4</td>
<td>88.9</td>
</tr>
<tr>
<td>Japan</td>
<td>99.9</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Korea</td>
<td>74.6</td>
<td>99.5</td>
<td>99.8</td>
</tr>
<tr>
<td>Singapore</td>
<td>63.3</td>
<td>90.3</td>
<td>92.5</td>
</tr>
<tr>
<td>China</td>
<td>48.5</td>
<td>83.7</td>
<td>89.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>31.6</td>
<td>72.3</td>
<td>79.2</td>
</tr>
<tr>
<td>Malaysia</td>
<td>50.4</td>
<td>89.9</td>
<td>93.0</td>
</tr>
<tr>
<td>Mongolia</td>
<td>75.8</td>
<td>91.4</td>
<td>92.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>20.8</td>
<td>65.6</td>
<td>75.7</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>24.2</td>
<td>49.1</td>
<td>56.9</td>
</tr>
<tr>
<td>Cambodia</td>
<td>16.2</td>
<td>45.2</td>
<td>52.7</td>
</tr>
<tr>
<td>Lao</td>
<td>17.8</td>
<td>48.5</td>
<td>56.3</td>
</tr>
<tr>
<td>Myanmar</td>
<td>27.6</td>
<td>58.2</td>
<td>65.9</td>
</tr>
<tr>
<td>Philippines</td>
<td>52.7</td>
<td>84.0</td>
<td>88.3</td>
</tr>
</tbody>
</table>

Source: World Bank staff calculations based on the data from World Population Program, IIASA
Table 3: Regional education trends in tertiary education also imply that labor force participation is expected to expand
(Share of population 20-64 years old with tertiary education in 1990, 2030 and 2040)

<table>
<thead>
<tr>
<th>Country</th>
<th>1990</th>
<th>2030</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong, China</td>
<td>15.9</td>
<td>34.0</td>
<td>35.7</td>
</tr>
<tr>
<td>Japan</td>
<td>23.5</td>
<td>55.2</td>
<td>60.5</td>
</tr>
<tr>
<td>Korea</td>
<td>15.6</td>
<td>49.7</td>
<td>55.6</td>
</tr>
<tr>
<td>Singapore</td>
<td>15.1</td>
<td>50.2</td>
<td>55.2</td>
</tr>
<tr>
<td>China</td>
<td>3.1</td>
<td>11.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.2</td>
<td>15.3</td>
<td>18.7</td>
</tr>
<tr>
<td>Malaysia</td>
<td>5.7</td>
<td>26.9</td>
<td>32.4</td>
</tr>
<tr>
<td>Mongolia</td>
<td>20.1</td>
<td>30.5</td>
<td>35.1</td>
</tr>
<tr>
<td>Thailand</td>
<td>6.8</td>
<td>27.6</td>
<td>33.9</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>3.0</td>
<td>9.3</td>
<td>12.1</td>
</tr>
<tr>
<td>Cambodia</td>
<td>0.5</td>
<td>3.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Lao</td>
<td>5.0</td>
<td>19.0</td>
<td>22.3</td>
</tr>
<tr>
<td>Myanmar</td>
<td>3.4</td>
<td>12.7</td>
<td>15.6</td>
</tr>
<tr>
<td>Philippines</td>
<td>15.4</td>
<td>37.4</td>
<td>42.9</td>
</tr>
</tbody>
</table>

Source: Staff calculations based on the data from World Population Program, IIASA

3.12 Healthy aging will provide potential for increased labor participation at older ages. The potential for growing employment at older ages will be determined to a large extent by gains in life expectancy and, especially, by gains in healthy years (Eggleston and Fuchs, 2012). Bloom, Canning, and Moore (2004) show that theoretically healthier life expectancies will extend working lives but that improvements tend to increase less than proportionately due to the income effect. According to Figure 33 and Figure 34, trends in LFPRs shown against the backdrop of gains in HALE years suggest the increasing potential for extending working lives in East Asia. For example, on average, Japanese men and women at age 55-59 in 2010 could expect to live 1.4 and 1.2 extra years compared to 1990. Notably, this “longevity dividend” is not gender neutral: since 1990 improvements in health adjusted life expectancy in the region have increased participation by women in Japan, China and Indonesia, but for men age-specific LFPRs did not change.
Figure 33: There is evidence that older men and women in East and South Asia are able to work later in life by virtue of rising health-adjusted longevity
(Male LFPR and HALE by age, 1990 and 2010)

Source: World Bank staff calculations based on GBD (IHME, 2013) and LABORSTA databases.

Figure 34: There is evidence that older men and women in East and South Asia are able to work later in life by virtue of rising health-adjusted longevity
(Female LFPR and HALE by age, 1990 and 2010)
3.13 A relative sense of the scope for higher participation can be inferred from cross-country comparison of participation rates set against the backdrop of the expected increase in the share of the elderly population. The following analysis examines how societies in EAP compare on two critical dimensions: population aging and capacity for labor force participation adjustment among older workers and women and through increased migration. The benchmarking of participation rates across countries in the region demonstrates that some economies with low participation rates have ample room for catch-up, while others do not.

3.14 Many aging countries have already attained high labor force participation among those who are over 60 which implies limited opportunity for significant adjustment. The regional participation rates among the elderly are already higher than in other regions (Figure 35). The EAP average is 53%, compared to an average rate of 35% in ECA and a rate in LAC which is close to that in EAP. Within the EAP region, Malaysia and Mongolia have the lowest participation rates among older workers. The more urbanized and wealthier countries, namely Japan, Singapore and South Korea tend to have higher rates, around 50-60%. At the other end of the income range are the young populations in which the elderly continue to participate at very high rates past the age of 60. High participation among older people in these populations is a result of subsistence necessity due to the higher share of rural employment. For example, the total participation rate is around 80 and 70 percent in Cambodia and PNG. The high rates of participation found in the low income countries are a poor guide for gauging prospects for increased participation among middle and higher income economies. In these countries participation is expected to decline with further urbanization, growing incomes and social security coverage. It would also not be desirable to suggest that rates should move to such high levels which represent dire subsistence necessity. Therefore, within group comparisons are more informative, for example for Reds benchmarking against Japan and for Orange countries benchmarking against Indonesia. For Red countries there is limited scope for growth since they are already close to Japan’s levels. Benchmarking against Indonesia shows that there is more promise for convergence among the countries in the Orange group.
3.15  **Wide disparity in women’s participation rates across countries suggests ample room for catch-up.** Figure 36 shows that this is especially relevant for countries with high rates of aging, namely Hong Kong, Japan, Korea and Singapore where women’s participation rates are around 50-60 percent. In comparison, Vietnam and Myanmar are also expected to age rapidly. But with participation rates already over 70 percent these countries are not as favorably positioned to attain a higher female labor force participation rate.

3.16  **In aging countries, immigration of relatively younger workers from other countries can help lift labor force participation rates.** Migration can provide a certain level of relief, especially in the short term, in the labor markets of aging countries which are suffering from the prospect of labor shortage. Migrants, on average, tend to be younger and exhibit higher rates of participation relative to natives. Two features distinguish the EAP region. First, there is significant variation in terms of demographic transitions. Thus, migration of young workers from countries with a younger workforce would benefit aging countries now and the lower income sending countries in the future by easing the aging crisis in both. Secondly, some of the intensely aging countries in region are marked by extremely low rates of immigration. For example, in Korea and Japan only 1-2 percent (WDI, 2013) of the population is international migrant stock. This low base effect presents a significant opportunity if inflows of new migrants aged 25-35 can be raised to 10 percent of the age 25-35 labor force. However, the low base effect is also indicative of social and political barriers to immigration which may be more difficult to overcome. Some economies with soon to be shrinking and aging workforces in the region are exceptionally open: Hong Kong, SAR and Singapore stand out with high international migrant stock which makes up around 40 percent of the total population.
3.17 In sum, there are compelling reasons to believe that adjustments to participation will follow from improved education, health, and migration. Furthermore, keeping in mind cross-country differences, participation can be promoted through labor and social security policy. From a public policy perspective, demographic outcomes are best treated as given while policy efforts are better channeled into influencing economic factors such as the participation rate. This leads to an additional worry: even if participation rates rise, will the increase be sufficient to compensate for the working age population’s declining share of the total population? The following section aims to examine this using a simple simulation framework.

How much difference will higher participation make to the supply of labor?

3.18 Can higher participation rates compensate for a declining share of the working age population in East Asia? While conceivable that the new demographic reality will activate higher participation through a variety of individual and policy responses, it is far from clear whether this increased participation will have a sufficiently powerful countervailing effect on the labor supply. The aggregate-level simulations presented in this section will explore this potential and will estimate how large the increases would have to be to temper the effect of population aging over the next 30 years. These simulations assess what could happen to the overall size of the national workforces under higher participation scenarios in the following decades. The scenarios include higher participation of older people and women and higher rates of immigration. In addition to these scenarios, a base case was constructed to analyze what would happen if labor force participation remains constant at 2010 levels. All projections span the period 2010-40 and rely on a detailed analysis of regional labor force participation rates across age and gender. The scenarios combine population projections from the latest revision of World Population Prospects (United Nations, 2012) with labor force participation data from the ILO (LABORSTA, 2011). The key assumptions for the base case and for the alternative scenarios are as follows:

- **Base case scenario.** The ILO publishes male and female participation rates for each 5-year age group from age 15 and average participation for individuals aged 65 and older. Taking these age and sex specific participation rates as given at 2010 levels and combining them with official population projections implies that the projected changes in the national labor forces are entirely determined by the population age structure projections over the 2010-40 period.

- **Convergence for women.** This convergence scenario assumes that female participation grows at an annual rate of 1/40th of the 2010 difference between men and women. This signifies that while women’s rates are assumed to converge towards male levels in 2050, the gender gap in participation will not be eliminated by the end of the period in 2040.

- **Increasing participation by older workers.** These projections assume increased participation for 60+ populations, where convergence to the maximum rate in 2050 is determined differently for the Red and Orange groups. For the Red group, participation rate for older men and women is assumed to gradually converge to the Japanese rates for 60+. For example within the 60-64 age group, the Korean participation in 2010 among males (females) was 70 (42) percent, and is assumed to reach 75 (45) in 2040. For the second group of aging countries the elderly participation rate will move to the Indonesian rates. Table 4 presents the starting and ending...
participation rates by gender assumed in the simulations. No alternative scenarios were estimated for the group with the lowest share of elderly, namely, Timor-Leste, PNG, Lao PDR, the Philippines, Cambodia and Myanmar.

Table 4: Starting and ending participation rates by gender assumed in the simulations
Elderly (age 60-64) LFPR under the "Elderly" scenario in 2040 and 2050

<table>
<thead>
<tr>
<th>Country</th>
<th>2010 (actual)</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60.5</td>
<td>60.8</td>
<td>60.9</td>
</tr>
<tr>
<td>Male</td>
<td>76.0</td>
<td>76.0</td>
<td>76.0</td>
</tr>
<tr>
<td>Female</td>
<td>45.7</td>
<td>45.7</td>
<td>45.7</td>
</tr>
</tbody>
</table>

Source: World Bank staff calculations

- **Migration scenario.** There are two migration scenarios analyzed – permanent and temporary – and the time frame considered is 2010 to 2050. In the case of permanent migration, the newly arriving immigrants are assumed to be between the ages of 25-35 and to comprise 10% of the
labor force of the destination countries in that age group. The assumption is based on the current levels observed in many countries that tend to accept mostly permanent migrants; these include the United States (13 percent) and EU members in Western Europe (8-15 percent). It is assumed that migrants only arrive in that age group, and they never leave. In addition, the migrants adopt the same fertility, mortality and labor force participation patterns of the natives. The analysis is performed for each five year interval starting in 2010. For example, in the case of Japan, we assume that the population of 25-35 year old native people increases by 10% in 2010 with the arrival of new migrants. In 2015, these people are now between 30-40 years old and another cohort of younger migrants arrives. The temporary migration scenario assumes that new migrants comprise 20% of the labor force between the ages of 25-35 but that the migrants stay for only ten years and then return to their home countries. Since they arrive for employment purposes, their labor force participation rate is assumed to be 100%. After ten years, a new cohort of the same group ages 25-35 arrives. This overlapping generation setup implies that the temporary migrants are never older than 45. The destination countries in the scenarios are Japan, Korea, Singapore, Hong Kong and Malaysia. They all have higher income levels, face aging-related challenges, and already have significant levels of immigrant workers (especially in the case of Singapore, Hong Kong and Malaysia.) The sending countries are Indonesia, Thailand, Vietnam, Cambodia, Lao PDR, Myanmar, the Philippines, Papua New Guinea, Timor and Mongolia. In contrast, these countries are relatively poorer and many already send large numbers of migrants to other countries in the region and around the world.

3.19 The intensity and onset of the decline in the labor supply in the baseline case is going to vary widely in timing and severity across EAP countries. Figure 37 presents the labor supply projections for the Red group. Decline has already started in Japan, and will accelerate, resulting in a workforce which is 20 percent smaller by 2040 than in 2010. Among other economies in the high-income group, Hong Kong SAR follows Japan in steepness of decline. The Korean workforce is expected to grow by an additional 6 percent and then proceed to a gradual decline reaching 2010 levels of workforce in 2040. Singapore is an exception to this trend: labor supply is not expected to decline in the foreseeable future but will stabilize at 120 percent of the 2010 level from the 2020s onwards. Overall, as a group by 2040 the total size of the labor force in these countries is expected to shrink by 12 percent.
Figure 37: The intensity and onset of decline in the labor supply in the baseline case will vary widely (Projected base-case changes to the labor force in East Asia and Pacific countries 2010-2040 (Red group))

3.20 There is still sizable supply growth in the Orange countries in the base case scenario, in large part due to Indonesia. As shown in
Figure 38, by 2040 the labor forces in these countries will extend their gains, ranging from 19 percent in Vietnam to 50 percent in Malaysia. And in comparison to China, Thailand and Vietnam, Mongolia, Indonesia and Malaysia are not expected to experience declines in their workforces until mid-century. This asynchronous timing of the labor abundance vs. deficit in the wider region implies that many of the Orange and “Green groups of countries can play a major role in supplying labor to address demographic imbalances in the aging countries, with gains to both supplying and demanding countries.
Figure 38: There is sizable growth in the labor supply of the Orange group of countries. Projected changes to the labor force in East Asia and Pacific countries 2010-2040 (Orange group). Change in percent relative to 2010.

3.22 China is the most populous country in the region and, according to the base case scenario, will have a disproportionate share of the total size of the labor force decline within the region. Though China’s population over 15 will continue to expand until the 2030s, in the base case scenario the labor force in China will start to decline gradually as early as 2015 and will be around 5 percent lower in size by 2040 compared to 2010. This seemingly contradictory prediction is explained by the fact that larger cohorts are growing older, shifting population share away from age 30-45 where participation rates are highest. The fact that LFPRs among the older groups are lower on average results in a divergent situation marked by an increasing share of population over age 15 coinciding with a declining labor force.

3.23 The higher participation scenarios for the Red and Orange groups of countries show that the gains in labor supply will vary across aging countries. More specifically, the analysis suggests that the surge created by gradually raising the participation rates is not able to fully counteract the decline everywhere. While in Japan higher female participation and increased migration significantly mitigate the impact on labor supply, these factors are not strong enough to overturn the effect. Among the other high income aging countries, higher participation by women provides the most forceful countervailing effect: for example, in Korea convergence cancels out the negative effect on labor supply entirely and delays the onset of the contraction of the workforce until 2035, as opposed to 2020 in the base-case scenario. Thus, the size of the labor force is 15 percent higher by 2040. In Singapore, labor supply continues to grow at a substantially steeper rate until the end of the projection period. Overall, encouraging women’s participation has a sizeable potential for activating the underutilized share of the working age population for two main reasons. First, there is a very large gender gap in participation among older people, which begins to widen at around 50 years. Second,
with aging populations a higher female LFPR is amplified by a greater share of older women in the workforce.

**Figure 39: The impact of higher participation rates will vary across aging countries**  
(Labor force projections under alternative scenarios)

![Graphs showing labor force projections](image)

Source: World Bank staff estimates

3.24 **Higher elderly participation is insufficient to make up the large losses expected in Red countries but does make a substantial difference in China.** In Japan, South Korea, Singapore, and Hong Kong SAR the prospects for mitigating aging effects through higher elderly participation are not as good as those associated with higher female participation. This is because participation of the elderly in the region is already very high. Notably, Japan and South Korea have the lowest effective retirement age among OECD countries where on average people retire later than pensionable age (D’Addio, Keese and Whitehouse, 2010). Unsurprisingly, under the assumption that elderly participation rates converge to Japan, higher participation provides an insignificant improvement in Korea and only a slight effect in Singapore. Therefore, for these countries higher elderly participation rates are only a partial remedy and must be part of a broader package of measures that also aims to stimulate total LFPR through higher participation by women and through migration. Note that this simulation only provides information about the intermediate input captured by labor supply and is silent about the intensity of economic utilization of the elderly workforce. For example, although mandatory retirement schemes in Japan and South Korea may not have significantly lowered participation rates among older workers, they may have still pushed older persons into doing jobs
unrelated to their main careers, which may be a waste of talent. In other words, the full economic benefits of incentives to retire later may not be fully captured by the marginal increases in labor supply allowed in this scenario.

**Figure 40: A gradual increase in the participation of older people makes a substantial difference in China**

*(Labor force projections under alternative scenarios, 2010 to 2040)*

3.25 Permanent or temporary migration increases the size of the labor force in the receiving countries.
Figure 41 shows the impact of the two different migration scenarios on the size of the labor force in the destination countries. The dark blue line is the baseline scenario with population size, labor force participation rates and age distribution as described in detail earlier. The green line corresponds to increased labor force participation by the elderly and the red line is when women participate at the same level as men. The purple line is the permanent migration scenario and the light blue line is the temporary migration scenario. As the figure shows, the impact of an increased female participation rate has a significant and sustained impact on the overall size of the labor force in these destination countries. Both types of migration increase the labor force size considerably in the short run and are superior in this time frame to increases in the female and elderly labor force participation rates. Temporary migration leads to the largest immediate increase in the labor force in the destination countries since the arriving cohort is bigger and they have higher participation rates. However, within twenty years the permanent migration scenario wins out since the migrants stay longer. The cumulative nature of permanent migration has a larger impact in the longer term, almost twice as much as temporary migration. Over time, as the migrants age and retire, the total labor force again declines, even with migration.
Figure 41: Impact of permanent and temporary migration on the total labor force size of the destination countries
(Aggregate labor force of Japan, South Korea, Singapora, Hong Kong SAR, and Malaysia)

Source: World Bank staff estimates

3.28 Migration leads to a decline of approximately 5 percent in the total labor force size of the migrant origin countries. The impact of migration on the origin countries is quite different since they are younger and have expanding populations. The permanent scenario assumes that the departing migrants never return while the temporary scenario assumes that migrants return after ten years and adopt the same fertility/mortality and labor force participation patterns of the natives of the same age group. The initial decline is very similar under both scenarios for the first two decades but the gap widens over time (See Figure 42). Permanent migration leads to a decline of around 5% in the labor force by 2050 while the impact of temporary migration is around half of that.

Figure 42: Migration leads to a 5 percent decline in the total labor force size of the migrant origin countries
(Total labor force size of the origin countries, 2010-2040 (millions))

Source: World Bank staff estimates
…but will they be hired if they come?

3.29 Although there may be room for further growth in labor supply through adjustments in participation rates, one question that receives less attention are factors constraining firm level demand for employing an aging workforce. Predictions regarding the impact of aging on labor markets must fundamentally consider demand-side effects. What will determine whether there will be more jobs for older workers? These demand-side factors include cohort associated wage effects, seniority rules in wage setting, and employment protection legislation (EPL) which may exacerbate barriers to employment for an aging workforce. Since the labor market is one of the principal channels through which the adverse impact of aging on economic performance can be mitigated, government policies to ensure a vibrant and dynamic labor market geared to respond to changing demographic forces are crucial. In this regard, current labor market trends in many Asian countries are a cause for concern. The ILO reports that global employment-to-population ratios (EPRs) have declined, with the EPR in 2012 being the lowest since 1991 (ILO, 2013). A declining EPR indicates a weakening in economies’ employment-generating capacity. In South Asia, the EPR declined by 2.2 percentage points while in East Asia the decline was 1.5 percentage points over the 2007-12 period. Notably, rising female unemployment contributed disproportionately to the declining EPRs, especially in East Asia (ILO, 2013). Global youth unemployment rates have also remained stubbornly high over this period, reaching 13.1 percent in 2013 (ILO, 2014). This is almost three times as high as the adult unemployment rate. These trends, if they continue, will negate any positive supply-side response in the labor market from falling fertility rates and higher educational attainment. These developments suggest the need for forceful implementation of active labor market policies to re-energize labor markets.

3.30 Limits on labor-contracting flexibility combined with seniority based wage setting will also limit the employment prospects of growing aging cohorts. There is evidence from OECD countries that wages appear to rise relatively steeply with age. Combined with evidence that employment rates are negatively correlated with the average earnings of older groups, this suggests that hiring older workers is likely to be affected by seniority-pay arrangements in firms. It will be important for the state to play a role by encouraging more flexible pay arrangements. For example, in Japan seniority clauses in public-sector pay arrangements are being replaced, thus flattening the age-wage profile. This is also exemplified by shifting practices in the Japanese private sector, which is switching from seniority to performance based pay, which itself may be largely an outcome of emerging labor mobility.

3.31 Broader employment protection regulations will influence employment of older workers in the East Asia region. EPL tends to favor incumbent older workers over women and youth. However, in the future EPL may also disproportionately discourage older “outsiders” at the expense of older “insiders.” Measures of regulation compiled by the World Bank (2014) show that average level of EPL is high in EAP but varies considerably across countries in the region. The average level of the EPL restriction index in ASEAN countries (1.8) is slightly lower than the average in the OECD, ranging from as low as 0.59 in Singapore to 2.79 in Indonesia. In fact, China, Indonesia, the Philippines and Vietnam stand out for having the most restrictive employment protection regulation.
In particular, much of the stringency reflected in the index stems from regulation of the dismissal of permanent workers and the hiring of workers on temporary contracts. A few high income countries such as Japan have relaxed their EPL; reforms have focused on extending the maximum length of temporary contracts, allowing renewals, encouraging firms to contract from temporary work agencies, easing severance payments, and shortening notice periods. While there is mixed evidence that EPL strictness can negatively affect hiring (World Bank, 2014), the experience of southern European countries would suggest that high levels of employment protection constrain countries’ ability to adapt to the aging challenge (Brunello, 2010). The way EPL may affect women's labor outcomes is difficult to predict. On one hand Japan’s Labor Standards Law may encourage more participation by women by restricting overtime. On the other hand, one can speculate that from a firm’s perspective the Labor Standards Law might lead to inefficient substitutions of the kind which discourages recruitment of women. In this case, the demand-side effect prevailed: deregulation of the Labor Standards Law led to a large increase in the proportion of female employment. (Kato and Kodama, 2014) While Kato and Kodama (2014) confirm gains from deregulation, a different carefully designed study Asai (2013) finds that a policy which reduced the costs of parental leave has not been effective in increasing female labor force participation. Therefore, the broad implications of EPL are difficult to predict, and will vary depending on the context and type of regulation.

3.32 Large cohort size of aging cohorts has a negative effect on the demand for and the wages and productivity of that cohort. A vast literature on the effects of cohort size on age-earnings and employment profiles developed beginning in the late 1970s in the United States. For example, Welch (1979), Berger (1989), and Murphy and Welch (1990) argue that firms will also rationally respond to the shortage of labor in aging societies. This literature came about largely to investigate the labor market opportunities of the baby boomer generation as they entered the labor market. According to this literature, cohort size has a negative effect on wages of that cohort, depressing the age-earnings profile. Thus, age-earnings profiles for the peak baby boom cohort were flatter than those of other groups. This effect arises due to imperfect substitution of workers across age categories, causing greater competition within larger cohorts which drives down wages. More recent evidence (Mosca, 2009) indicates a negative impact of own-cohort size on the employment of male workers. Macunovich (1999) also suggests that the aggregate demand effects of own-cohort size have a disproportionate impact on those at the lower end of the skill and experience spectrum. This finding has important implications for aging societies. It suggests that there will be a steepening of the age-earnings profiles for smaller cohorts entering labor markets in the aging countries within the region. Incentive theory would then imply a steepening of lifetime productivity profiles for these cohorts (Lazear, 1979). A second implication is that induced increases in labor force participation of older workers (achieved by extending the retirement age) would not be matched by increased demand for their labor because of imperfect substitutability- the steeper productivity profile of younger cohorts means they will be more valuable than older workers. For the older workers, this implies that early retirement is in fact efficient. A third implication arises from the impact of female labor force participation. Younger cohorts of women have higher participation rates in general, even in aging societies. To the extent that this trend mitigates the effect of smaller cohort sizes entering the labor market due to aging, the impacts on age-earnings and productivity profiles might be less pronounced. However, the extent to which increasing female participation will counter the effect of aging will depend on the degree of substitutability across genders. With this background in mind, it is reasonable
to speculate that the employment and wage effects of cohort size are more likely to affect the high-income countries which are already confronting the aging problem (Japan and South Korea, for example). Middle and low-income countries in the region, on the other hand, are characterized by relatively high male LFPRs, even at older ages, and are likely to experience increasing female LFPRs in the coming years. Thus, it is unlikely that these countries will face the effects of small cohort sizes entering the labor market in the medium-term.

3.33 Population aging combined with policies which encourage extended working lives will bring up concerns about the employment opportunities of younger people. This view is reflected in various polls that confirm that roughly 60 percent of those polled are concerned by a perceived generational conflict over jobs, a view that is disproportionately higher among women and less educated and older persons. The view that there are a fixed number of jobs – the “lump of labor” hypothesis – has been explored by several studies which focused on OECD and US labor markets (For a survey of literature see Gruber, Milligan and Weiss, 2009 and Munnell and Wu, 2012). These studies compared the employment rates of older persons and the unemployment and employment rates of younger persons using various estimation methods and find that there is no indication that an increase in the employment rate for older people reduces employment opportunities for younger people. These studies conclude that there is a tight relationship across countries between social security incentives to retire and the proportion of older persons out of the labor force. But the proposition that more work by older persons reduces the job opportunities of younger persons is not supported. Figure 44 demonstrates a tight correlation between the employment rates of 55-59 year olds and younger persons who are 20-24 years old and is inconsistent with the proposition of a fixed number of jobs. There is even evidence that older and younger workers are good for each other: this line of thinking proposes that older and younger workers are complements, suggesting that increasing the employment of older persons provides more job opportunities for younger persons (Levine and Mitchell, 1988). Additional evidence against the lump of labor fallacy can be gleaned from the flow of women into the labor force in the past few decades, which has swelled the size of the labor force enormously while the employment rate of men is only slightly negatively correlated to the percent increase in female employment (Figure 43). Even that decline has been linked to other factors, confirming a view that the economy expands to absorb new labor.
Figure 43: There is no indication that an increase in the employment rate for older people reduces employment opportunities for younger people (Change in female and male employment rates)

Source: Gruber and Wise, 2009

Figure 44: There is a close correlation between the employment rates of 55-59 years olds and that of 20-24 year olds (Employment rate of 20-24 and of 55-59 year olds in 2009)

3.34 In sum, there is demonstrable potential for higher participation to boost the size of the workforce. But addressing barriers to employment to foster demand will be essential, which will require labor markets which respond to the changing composition of the work-force, and in which skill mismatches and other rigidities are not allowed to create a wedge between demand and supply. The potential for increased employment can be activated by weakening barriers to work for women, elderly and migrants, all of which adds up to a powerful countervailing force in dampening and in some cases even overturning the decline in the labor force predicted in the base-case scenario. Yet, it should be noted that activation of higher labor force participation only provides a temporary “shot in the arm” and only delays the inevitable decline in labor supply due to aging. The long run response to aging societies can only be achieved by improving growth rates of human and physical capital and total factor productivity, which is the focus of the following Chapter.

4. Aging and Productivity

4.1 The quantity of labor input\textsuperscript{11} gives only a partial account of the economic consequences of population aging. In the previous section, the impact of aging on the size of the labor force under a base-case scenario is estimated, as is the potential for mitigation from increased participation of certain population groups. In some countries, the base-case scenario predicts a contracting labor supply due to population aging, as the number of older workers leaving the labor force exceeds the number of young workers joining its ranks. Even when the size of the labor force remains stable as the population ages, its age composition does not. Some labor supply scenarios envisage the rise in female, elderly and migrant participation to compensate for a decline in the total labor force size. Implicit in all these scenarios is the changing age-composition of the labor force, which raises the question of the substitutability of labor across age groups and cohorts.

4.2 A measure of the quality of the labor input\textsuperscript{12}, labor productivity completes the picture. As the workforce dwindles in Red countries, the effective labor force may not necessarily shrink, provided that labor productivity rises to offset the decline in the ratio of workers to population. Similarly, the magnitude of the economic gains in Green and Orange countries from growing workforces depends on their productivity. Labor productivity is defined as the amount of goods and services that an employed worker produces in a given amount of time. It can be measured for a process or task, a firm, or for an economy as a whole. At the individual level, a worker’s productivity is determined by her age, investments in her education and health made during her lifetime, and by the machinery with which she is equipped to produce. Aggregated at the country level, labor productivity depends on the age distribution of the population, as well as on the capital stock and technology, and on the efficiency with which these factors of production are put to use. Aging has different implications for productivity at these different scales, and variations in human and physical capital across cohorts of

\textsuperscript{11} Here labour productivity is loosely defined as output per employed worker. It therefore ignores unemployment rates, and incorporates human and physical capital as well as total factor productivity into its measurement of the productivity of labour.
workers can heighten or counteract the effects of population aging on the labor force. These issues are addressed explicitly in this section.

**Age and individual labor productivity**

4.3 **How individual productivity varies with age is a challenging empirical question that has important implications for aggregate productivity, particularly in advanced economies where the workforce is aging and shrinking.** At the micro level, the main question is how individual productivity changes across a worker’s lifetime, which is prone to major measurement and methodological limitations. One particular challenge to measuring productivity at the individual level is that production in a firm involves collective action and an interdependent ecosystem of individuals and processes. But some broad lessons can be drawn from the empirical research using industry and firm level data. At the macro level, aggregate productivity varies with levels of national savings, human capital accumulation and the efficiency with which the factors of production are used, referred to as Total Factor Productivity. Population aging has implications for growth through its direct impact on workers’ labor productivity as they age, but also through its impact on capital accumulation, total factor productivity, and innovation.

4.4 **It is misleading to rank worker productivity by age along a single dimension, as skills and aptitudes at different tasks can move in opposite directions with age.** On the one hand, mature workers are generally more risk-averse and less entrepreneurial; hence they could be thought to contribute less to innovation and growth. On the other hand, older workers have amassed a greater stock of human capital, job-specific skills and general experience, which should make them more productive than younger workers. It is particularly challenging to establish the relative merit of these competing hypotheses since productivity is difficult to measure individually (Skirbekk, 2004; Johnson, 2002). Box 2 below outlines some surprising findings about age-specific productivity, and the difficulties in drawing inferences from individual productivity measurements.

4.5 **Empirical evidence from Japan and other aging countries suggests that the age-productivity profile of workers follows an inverted U-shape, with a mild decline after the mid-40s and a significant dip only after 65 (see Box 3).** Estimates of age-productivity profiles that emerge from industry or firm-level empirical research in Japan have consistently found it to follow an inverted U-shape with respect to age, peaking for employees at around 20 years of experience, corresponding to an age of 40 to 46 years old (Ochiai, 2008; Shirakawa, 2009). But the productivity does not seem to fall rapidly after that. In fact, research from Japan on an all-industry (excluding agriculture and the public sector) basis found that the labor productivity of the 55 to 59 age group is virtually identical to that of the 40 to 44 age group (NIRA, 2010). Concurrent evidence has come out of other advanced economies. Research from Austria using employer-employee data finds that firms with a larger share of employees below the age of 30, all things kept equal, have lower productivity and wages, while the same is not true for firms with a larger share of older employees aged 50+ (Mahlberg et al., 2013). An accumulation of high shares of older adults in Swedish manufacturing plants was also found not to negatively impact plant-level productivity (Malmberg et al., 2008). At worst, no evidence of age-related productivity decline is found (Göbel and Zwick, 2009).
Evidence that emerges from empirical research in advanced economies is somewhat contradictory. While the productivity-age profile is robustly found to follow an inverted U-shape, with the peak age somewhere between 35 and 54, macro estimates of the impact of age on aggregate productivity find that older workforces are at worst just as productive as younger workforces.

There are several possible explanations for this. First, individual worker productivity does not dramatically decline after it peaks around age 40. The decline is found to be very mild relative to the rise in productivity in the first 20 years of work experience in various studies in Japan (Shinada, 2011; Fukao et al, 2006;). In a famous study of a Mercedes car manufacturer, Börsch-Supan and Weiss (2007) also find that productivity does not begin to decline until the age of 60. Among OECD countries, the share of 50-64 year olds was found to have a positive influence on growth, while a higher share of 65+ contributed negatively (Lindh and Malmberg, 1999).

Secondly, as noted previously, there may be some issues with the research methodology which bias the results. It is likely that the decision to retire or retain a worker as she ages depends on the productivity of the worker. It follows that when measuring the productivity of older workers, only those elderly workers with “high enough” productivity can be surveyed, whereas this selection effect is much less present among younger workers.

Thirdly, the link between age and productivity is also highly dependent on the context and task under consideration. In general, productivity reductions at older ages are strongest in job tasks where problem solving, learning and speed are important, while for work tasks where experience and verbal abilities matter more, there is less or no reduction in productivity among elderly workers (Skirbekk, 2008).

But here again, some surprising results have emerged from the research. Older workers who remain in the labor force despite technological changes which affect their job content are found to have adapted well, experiencing greater growth in tasks with intense use of cognitive abilities (Romeu Gordo and Skirbekk, 2013; following a line of research initiated by Autor et al., 2003). Focusing on the distinction between mental and physical productivity, Van Ours (2009) find that while the latter declines after age 40, the former does not.

Finally, productivity is not only an individual, but also a team concept, and there is evidence that skills of the old and the young may be complementary in some contexts. Grund and Westergeod-Nielse (2005) find that those companies with an age mix of workers are actually more profitable than those with exclusively young or old workers.

4.6 In Red countries, past trends in the age distribution of the population have been particularly propitious to workforce productivity growth, but their reversing trends do not necessarily
imply dramatic reductions in productivity. A higher share of prime age individuals in the population, sometimes defined as the 30-54 age groups, has been found to be significantly associated with high productivity growth (Gomez and Cos, 2008). From the mid-60s to the mid-2000s, the share of 35-54 rose and peaked at a ratio of one in three people on average in the Red countries before declining again (Figure 45). Taking other things as being equal, the workforce in these countries could be expected to experience a steady decline in labor productivity as it ages rapidly in the next 30 years and these prime age groups are less represented. However, all things will not be equal. To begin with, the cross-sectional evidence ignores cohort effects that drive a worker aged 60 today to be both more productive and more able to acquire new skills than a worker of the same age three decades prior (see Box 4). Human capital, health and savings are three such factors that evolve alongside the aging of the population, with important implications for cross-cohort comparisons. These are addressed below.

4.7 In Orange and Green countries, the maturing of the population offers increasing opportunities for productivity growth, yet the pace of growth will depend on physical and human capital investments, and how efficiently they are put to use. The next 15 to 20 years will see a rise in the average share of the prime age population of Orange countries, although a flatter rise than that experienced in the 30 years since 1985. Green countries should experience some positive growth in labor productivity from the maturing of their workforce, peaking around 2045. Yet while the age-productivity profile is the most obvious link between population aging and labor productivity, aggregate productivity growth in the future will be determined by investments in human capital and the quality of education supply, which are notably very low in some Green countries. Savings behavior and the types of saving mechanisms available to households will also have a determining role, as will the capacity of the economy to make efficient use of these human and physical inputs. So what impact does the empirical evidence suggest should be expected from aging in the region on these other determinants of productivity and growth? The following two sections examine the role of human capital and savings.

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Aging Populations and Human Capital

4.8 While the Red countries are in a strong global standing in terms of educational attainment and skills, some Orange countries and many Green countries are still far from par. Recent cross country evidence on education from the OECD (PISA, 2012) shows that the East Asia region, in particular richer countries and sub-regions, out-performs the world, notably in terms of mathematical literacy. Shanghai, Singapore, Hong Kong SAR, South Korea, and Japan are above the OECD average. Vietnam’s performance is also exceptional with 15 year olds performing on par with peers in Germany and Austria. But other countries in the Orange group such as Thailand, Indonesia, and Malaysia lag behind the OECD average. Furthermore, according to the Programme for the International Assessment of Adult Competencies (PIACC), which measures capacity for re-training and adaptation among adults in an aging environment, Japan leads globally, with South Korea close to the OECD average and ahead of countries such as the UK, Denmark and the US. More alarming is the state of adult skills and competencies in Green countries, such as Lao PDR (World Bank, 2013a) and Timor-Leste (World Bank, 2013b) which have scored very low on core literacy tests (ETS) as part of the World Bank’s STEP skills measurement program.
Severe child health and nutrition problems in some Green countries, could seriously curtail the demographic dividend. Several Green countries in the region have some of the highest rates of stunting in the world, with up to 44 percent of children below age 5 being stunted (Figure 46). Children who are stunted, generally as a result of inadequate feeding practices at an early age, are more likely to have lower cognitive abilities, as documented extensively in the literature. Key parts of the brain develop less in children who are severely malnourished, making it much more likely that these children will never make it to school or will drop out early. Compared with non-stunted children, stunted children score 7 percent lower on math tests; are 19 percent less likely to be able to read a simple sentence at age 8; are 12 percent less likely to be able to write a simple sentence; and are 13 percent less likely to be in the appropriate grade for their age at school.

**Figure 46: Prevalence of stunting among children under age 5 (%)**

![Graph showing prevalence of stunting among children under 5 by GNI per capita (2005 dollars).](image)

Notes: GNI per capita is based on 2011 figures. Stunting rates are latest available data. Source: WDI

4.10 Falling fertility rates are usually associated with greater parental investments in education and health of children. However, translating these investments into productivity growth requires public investments in the supply and quality of education. Becker and Lewis (1973) and Willis (1973) first described the quality-quantity trade-off which occurs as parents have fewer children and they invest more in the human capital of each of their children. Indeed, according to Table 2 and

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14 Prevalence of stunting is a measure of severe child malnutrition. It is measured as the percentage of children under age 5 whose height for age is more than two standard deviations below the median for the international reference population ages 0-59 months.
4.11 Table 3 the increasing levels of higher education between 1990 and now have been particularly impressive in Green countries and are set to continue to 2040. The approximate doubling of secondary education rates and the three- to tenfold increase in tertiary education rates hold the promise of contributing significantly to raising the effectiveness of labor. Yet, while the association of longer schooling years and productivity improvements is well established in countries with an adequate supply of high quality education\(^\text{15}\), productivity gains in Green countries will rely on further improvements in the quality of education. As discussed in Gove and Wetterberg (2011), recent research reveals that it is learning, not years of schooling, which contributes to a country’s economic growth. It has been estimated that a 10 percent increase in the share of students achieving basic literacy translates into an annual growth rate that is 0.3 percentage points higher than it would otherwise be for that country (Hanushek & Woessman, 2009). Figure 47 below shows that while some Orange countries, such as Malaysia, Thailand and Vietnam are investing in education, many of the Green countries still lag in terms of public spending on education.

![Figure 47: Public spending on education (as share of GDP)](source: World Bank Edstat)

\(^{15}\) See, for instance, the literature on education and wages using identical twins to identify a 10% difference in wages for each additional year of schooling (Ashenfelter and Krueger, 1994; Ashenfelter and Rouse, 1994), Angrist and Krueger (1991)’s seminal paper using births in the first quarter as a natural experiment, or Ashenfelter and Zimmerman (1997)’s use of siblings to distinguish the effects of education from family factors.
4.12 In Red and some Orange countries, rising investments and predicted trends in secondary and particularly tertiary educational attainment could compensate for future declines in labor supply by raising worker productivity. Better-educated people are more prepared for life-long learning, healthier, and more productive. Bloom, Prettner and Strulik (2013) show that under plausible production function specifications, the rise in education and health investments that is in part spurred by declines in fertility rates raises workers’ productivity enough to compensate for the declines in labor supply. And according to Lee and Mason (2010) the impact of spending on education is strong enough to offset the adverse effects of population aging. Significant rises in education levels will be particularly important sources of growth in the aging Orange countries where the levels in 1990 were low. For example, secondary education is predicted to more than double in Indonesia and Thailand, while rates of tertiary education will rise by a factor of four or five in most countries of this group by 2040. For Red countries where the educational gap across cohorts of workers is narrower, other forms of lifelong education and retraining of older workers which are not reflected in the education tables above deserve further attention. These are explored in the box below.

**Box 4: The scope for upskilling an aging workforce**

It is a commonly held belief that the ability to learn new skills declines with age. In particular, Baltes, Lindenberger and Staudinger (2006) find that the speed at which an individual processes new information declines from the age of 25 onwards. Cognitive plasticity, the ability to learn, appears to follow an inverted U-shape over an individual’s lifetime. Should we then conclude that older workers cannot be retrained to renew their skills if these become obsolete?

Recent research has come to light that nuances this conventional wisdom. First, as successive cohorts are healthier and more educated, their brains function better. This phenomenon, known as the “Flynn” effect, suggests that testing a cross-section of elderly people at one point in time ignores improvements across cohorts. As the cognitive plasticity curve shifts up with each cohort, then, future aged workers should not be judged by the learning abilities of the current elderly. Second, as healthy life expectancy is increasing, the cognitive decline is found to start later in life. Skirbekk, Stonawski, Bonsang and Staudinger (2013) conclude that the cognitive plasticity curve is not only shifted up, but also outwards: individuals are more able to learn at each age, and the decline occurs increasingly late in life. Third, scientific evidence shows that the decline is not deterministic and the elderly’s ability to learn improves given the right circumstances. Physical exercise has been found to revitalize key cognitive parts of the brain that improve learning abilities (Voelcker-Rehage, Godde and Staudinger, 2011, Christensen et al, 2013), and learning outcomes among the elderly are particularly responsive to motivational factors and supporting attitudes in the workplace (Kessler and Staudinger, 2007).

While there is little conclusive evidence about the effectiveness of government-run retraining programs at keeping the elderly in productive work, and few examples of training provided by firms, the aforementioned evidence suggests that provided the right environment, the elderly’s ability to learn is not the main explanation. Rather, externalities inherent in training, and the stigma surrounding elderly workers may be responsible for the lack of such initiatives.
4.13 Finally, there is strong potential and need for total factor productivity convergence as it explains some of the variation in productivity across countries in the region. TFP growth is the only macroeconomic indicator that is widely accepted to determine long-term growth. Unlike physical capital that can stimulate growth in the short run, it eventually becomes unsustainable due to shrinking marginal returns to further investments. Figure 48 below shows the large gap between countries such as Singapore and Japan that map out the TFP frontier, and those who are marked by lower TFP such as China, Indonesia and Thailand. The gap suggests tremendous scope for developing skilled higher-value added sectors, and improving inter-sector and intra-sector efficiencies. The availability of frontier technologies suggests that it may be easier to converge towards the leaders through imitation and learning. That said, the differences in overall productivity, which is GDP per employed worker, in between Red and Orange countries are primarily driven by human capital and individual productivity. The previous two sections of this chapter focused on these factors, while the next section describes the relation between aging and physical capital.

![Figure 48: Total Factor Productivity trends in some EAP countries](source: Penn World Table version 8.0, 2013)

**Saving for a Productive Aging Workforce in East Asia: Will Aging Play an Influential Role?**

4.14 The net effect of aging on labor productivity depends on the capital stock and how capital accumulation evolves with population aging. The concerns over capital in aging countries stand out against the backdrop of the important role played by domestic savings in the high growth experience of East Asia. Savings not only funds investment in capital but notably allows lower-income countries to adopt frontier technologies, which matters enormously for growth (Aghion et al, 2009). In East Asian countries, the average private savings rate between 1960 and 2000 was 25%, far exceeding those of other regions, of which China accounted for the predominant share of this impressive
increase since the 1960’s. A study by Horioka and Terada-Hagiwara (2012), also indicates that there is tremendous variation in domestic savings rates among the twelve economies in the sample, with the nominal domestic savings rate ranging from well over 30 percent in Singapore, China, Malaysia and Hong Kong, to below 20 percent in Vietnam and the Philippines over the 1966-2007 period. While household savings have fluctuated considerably, corporate savings have been on a steady upward trajectory since 2001. These stylized facts raise concerns that aging populations will dampen savings and thus limit their growth prospects.

4.15 However, predictions regarding the impact of aging on the stock of capital in East Asia are mixed\(^{16}\). The demographic effect on the savings rate is difficult to predict because the different demographic transformations driving population aging will have ambiguous effects on the savings rate. Two offsetting effects determine the net effect of longevity on aggregate saving: (1) a compositional effect that leads to a reduced aggregate savings rate because of an increase in the share of retirees in the adult population; and (2) behavioral effects, such as the rise in the individual savings rate to finance a longer expected duration of consumption in retirement. Predictions on which of these two effects will dominate in East Asia are mixed. Some authors suggest that the composition effect will dominate the behavioral effect (Bloom et al., 2003), while others maintain that extensions in longevity will have a positive impact on savings rates in the future. (Kinugasa and Mason, 2007, and World Bank, 2013).

4.16 Whether aging in East Asia will adversely affect capital growth prospects depends on three regional characteristics. First, the patterns of life-cycle profiles of savings, which will affect the scale of the compositional effect as the population age distribution changes. Second, the adjustments to savings behaviors in response to lower fertility and increased longevity. Third, the improving efficiency in savings associated with social security and the increasing quality of financial markets. The rest of this chapter weighs each of these factors in the context of East Asian countries.

4.17 Under the lifecycle savings hypothesis (LCH) developed by Modigliani (1970), demographic factors are important determinants of savings rates, but empirical evidence from East Asia is mixed. According to the life-cycle model of savings, people save when young, and dis-save to finance consumption during retirement. From a macro-economic perspective, the life-cycle theory implies a decrease in the national saving rate in an aging economy\(^{17}\) because the share of retirees in the adult population increases. Furthermore, at an aggregate level aging reduces returns and hence incentives for households to save by driving up the capital-labor ratio, especially in rich countries.

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\(^{16}\) Studies which have shown strong links between national saving rates and age structure include those by Fry and Mason (1982); Mason (1988); Higgins (1998); Kelley and Schmidt (1996); Deaton and Paxson (1997); Lee et al. (2000); (2001); and Bloom et al. (2007).

\(^{17}\) In theory, there is no aggregate saving in a stationary population because in the absence of a bequest motive, the dissaving of the old and the saving of the young cancel out (Ando and Modigliani (1963) and Bloom et al (2003)). However, when there is population growth or if the economy is growing rapidly and incomes of wage earners are high relative to the incomes of the retired, there may be aggregate savings or dissavings.
Empirical evidence on savings is broadly consistent with the main predictions of the life-cycle theory (Browning and Crossley, 2001). Attanasio and Szekely (2001) find that household savings are consistent with the LCH in Peru, Mexico and Thailand but only for the most educated households. Evidence for Japan from both macro and micro studies is consistent with the LCH. The retired elderly as well as the working elderly dis-save in Japan. However, the exceptional increase in savings rates in the wider East Asia region between 1950 and 1990 is difficult to reconcile with the LCH. Demographic changes and income inequality between cohorts can explain only a small part of this trend. A singular feature of the East Asian savings surge during this period is an increase in the rate of saving at every age (Deaton (1992) for Thailand and Deaton and Paxson (1992) for Taiwan). This feature is inconsistent with the standard life-cycle theory. Schultz (2004), for instance, finds that changing age-structure across 16 Asian countries during the period 1952-1992 had an insignificant impact on aggregate savings rates. An analysis of profiles of life-cycle income and consumption flows using National Transfer Accounts across China, Thailand, South Korea and Vietnam also suggests that labor income for the wider region starts at older ages but consumption profiles remain essentially flat from around age 20, while labor income continues to be positive at older ages. A stronger bequest motive and sparse coverage of public pensions in East Asia appears important in reconciling this pattern. All in all, the compositional effect of aging on savings may be more muted in comparison to other regions.

4.18 A number of behavioral factors can also potentially mitigate the adverse impact of aging on savings in East Asia, thus making the likely impact on aggregate savings modest. Canning (2007) emphasizes the role of other behavioral factors in response to the changing age structure of populations which might mitigate the adverse effects of aging on savings. As discussed in Chapter 3, declining fertility is associated with higher female labor force participation (Bloom et al., 2009), which implies higher national savings due to the income growth of a larger female labor force. Increased life expectancy can lead to increased working lives or increased savings to fund retirement. Bloom et al (2003) incorporate longevity in a standard life-cycle model of savings and show that, under certain assumptions, longevity leads to higher savings rates at every age. Their model thus fits the data on East Asia well. However, the effect of longevity on aggregate savings is transitory, and dissipates as the population ages. They thus conclude that the positive effect of increases in life expectancy on savings in East Asia will dissolve as the population ages. Kinugasa and Mason (2007) have a more optimistic view. Their model of savings incorporates declines in youth dependency as well as increases in life expectancy, and fits the savings trends in West and East Asian countries. They find that the increase in life expectancy is the more important determinant of savings, accounting for three-fourths of the increase in Asia. Moreover, their analysis predicts that the behavioral effect of longevity increases outweighs the compositional effect, implying that population aging will not lower savings in Asia. Using cross-country panel data, Li et al. (2007) find that the effect of increased longevity on aggregate savings is positive while that of an increased old-age dependency rate is negative. World Bank (2013c) also contends that the drag on savings from the compositional effect will be offset by the behavioral effect in East Asia.

18 Horioka (2010) and references therein.
4.19 The concern about reduced capital investment induced by aging may be misconceived; as broader macro-economic channels are likely to play a dominating role. Firstly, a precautionary motive appears to be driving high savings in East Asia suggesting important inefficiencies despite high national rates of savings. Secondly, further financial liberalization may contribute to a decline in the savings rate, which will be a sign of improved efficiency. Finally, improvements in financial intermediation, inclusion and social security coverage will play a crucial role in determining levels of savings and in channeling savings into productive investment. The following sections elaborate these channels further.

4.20 A precautionary motive appears to be driving high savings in East Asia suggesting important inefficiencies despite high national rates of savings. Blanchard and Giavazzi (2005) stress the importance of reducing precautionary savings in order to boost consumption and rebalance growth. There is now a strong consensus among economists and policy-makers that China must rebalance its economy to rely less on investment and exports and more on domestic consumption in order to continue its strong economic growth (IMF, 2007). There are multiple reasons for high rates of precautionary savings. In China, market-oriented reforms led to large-scale corporate restructuring and the downsizing of the public sector between 1995 and 2005, weakening the public social-safety net in the process. Households responded by building up savings to self-insure against future health and pension needs (Ma and Yi, 2010). Chamon and Prasad (2010) also find that the elderly in China are saving more as the state-funded health care system is inadequate to meet the rising demand for health care among these households. Therefore, even if savings rates decline in future, and even if due to the aging effect, the impact may not be all bad. The precautionary motive for the high rate of saving suggests that there are efficiency gains to be made by shifting from high rates to low but higher quality of savings. One way to undermine the need for precautionary savings is for governments to expand social insurance in developing countries, and guarantee stable and secure old-age support for households. But a precautionary motive also appears to explain the high corporate savings rate in China. In the future, policies decreasing income volatility will lessen the need for inefficient precautionary savings by firms. A more general model by Cherif and Hasanov (2012) predicts that it might be optimal for a country to accumulate large precautionary saving when faced with high volatility of permanent income shocks. An increase in the variance of permanent income shocks implies not only a higher savings rate but also a change in the portfolio allocation of savings towards safe assets, and a decrease in investment. The authors point out that after the 1997-‘98 economic crisis in Asia, some Asian economies switched from low savings and high investment (current account deficits) to high savings and low investment (current account surpluses).

4.21 Financial liberalization may contribute to a decline in the savings rate, which will be a sign of improved efficiency. With liberalization, easier access to credit reduces firms’ incentives to save; the empirical evidence suggests that the relationship is negative. Huang (2011) finds that private firms save more than state-owned enterprises (SOE) to overcome limited access to finance. IMF (2009) presents the impact of financial liberalization on corporate savings in Asian as well as non-Asian countries using estimates based on firm-level data. The analysis reveals that the impact of financial reforms is considerably larger in Asia. Based on this evidence, financial sector reforms are likely to
sharply reduce precautionary savings by the corporate sector in Asia. In fact, recent policy changes indicate that many middle-income countries in the region are already moving in this direction.

4.22 **Improvements in financial inclusion will play an important role for channeling savings into productive investment.** It is a given that increasing use of financial inclusion, either through bank or non-bank financial institutions, allows for the efficient flow of savings and investments in the economy (McKinnon, 1973). Levine et al. (2000) and Beck and Levine (2001) identify three indicators of financial sector development that best explain the differences in economic growth between countries over long periods: bank credit to the private sector, stock market activity (proxied by the turnover rate or the ratio of traded value to GDP), and features of the legal system such as the extent of shareholder and creditor protection. Gavin and Hausmann (1997) and Aghion et al. (2005) underline the important role played by credit markets in the macroeconomy. Using a cross-section of data from different countries, they find that deeper credit markets mitigate the detrimental effects of volatility and exogenous shocks on growth. The corporate sector in Thailand appears to rely heavily on banks, with nearly 75 percent of firms using this source for financing investments. Less than half the firms in other countries use bank financing, and the share is notably small for the relatively poor countries (Vietnam, Cambodia, Philippines). Gross capital formation (GCF) also varies across countries in the EAP region, with China investing nearly one half of the value added in the economy while the other countries invest considerably less. At the household level, the efficiency of financial inclusion, as marked by bank account penetration, differs across countries in the EAP. With a rate of 55 percent, EAP is ahead of most regions in bank account penetration and only behind high-income economies, yet access to personal savings instruments and credit varies significantly across the member countries. According to Demirguc-Kunt and Klapper (2012) in countries such as Cambodia more than 95 percent of adults do not have an account at a formal financial institution. In sum, these regional stylized facts reflect that, aging pressures notwithstanding, EAP countries have varying abilities to mobilize savings, allocate capital efficiently, and diversity risks, which suggests that significant gains remain to be made.

4.23 **Addressing concerns about savings in the region which will require improved social security and the deepening of financial markets and the role of bank to sustain strong economic growth.** Ultimately, the effect of aging on capital formation in EAP will depend on the interaction of a number of factors – the pace, magnitude and intensity of the demographic changes themselves, the consequent behavioral adjustments in response to fertility and longevity changes, and the macro-economic environment. Numerous behavioral factors spurred by lower fertility and longevity suggest that the compositional effect of aging may be overcome. Furthermore, the region is already marked by high savings rates, and in the future will be subject to macro-economic forces, international capital flows, financial deepening and expansion of social security which may dominate the older age composition effect. All of these factors make predictions of aging impacts on savings extremely tentative and suggest that the demographic effect may not be the primary factor determining capital formation as other macro-economic forces may have a more direct influence. Far more importance will need to be paid to the design of social security and to financial development, but also as pointed out in Chapter 3 to fostering dynamic labor markets. The ILO (ILO, 2013) has expressed concern about jobless growth in many emerging economies in the last decade or two, and about the continuing lackluster
performance of labor markets throughout the world, which with their alarmingly high unemployment rates preclude savings in the first place.

4.24 In summary, Chapter 4 showed that while labor productivity differentials across the region remain the biggest difference between these groups of countries, there is tremendous potential for productivity convergence to counter aging effects. Labor productivity is much higher in Red countries than in Orange or Green countries. In fact, this difference explains a far larger share of the difference in income per capita between these groups of countries than do labor force participation or demographics. If Orange countries are to maintain their impressive growth rates of the past few decades, they will increasingly require improvements in human capital and TFP, as demographic forces become less favorable. There are reasons for optimism as healthier and more educated cohorts will be better prepared for the prospect of longer working lives than previous generations. Achieving this second demographic dividend will also rely to a great extent on fostering dynamic labor markets, and deepening of financial markets. In the case of the Green countries which are still progressing through their demographic transition, dramatic fertility declines are raising the demand for human capital. Only if this demand is met with dramatic investments in the supply and quality of education (and for some countries, in child health) will these countries benefit from a demographic dividend that can propel their economic growth. But convergence in income per capita to the levels of Japan and South Korea remains a major challenge for lower income aging countries. The next chapter brings the demographic, labor, and productivity channels together to explore base-case and best case scenarios of aging’s effect on per capita incomes using two illustrative case-studies: Japan and Indonesia. These scenarios bring into sharp focus the divergence in paths of lower-middle income countries relative to the older, richer countries in the region.

5. Scenario analysis of future aging and growth

What future income paths for EAP countries?

5.1 Over the past thirty years, the countries in EAP have followed very different demographic and economic “paths.” Figure illustrates this clearly by mapping the evolution of GDP per capita (in PPP terms) and elderly dependency for the countries in the region from 1980 to 2010. Each line traces a single country’s “path” in this economic-demographic space by chronologically linking the available data points from 1980 to 2010. The Green countries, which are just beginning to undergo a demographic transition, have lingered in the bottom left hand corner at low levels of per capita income and low elderly dependency. Early declines in youth dependency have even shifted some of them towards the left since 1980 as the working age share of the population began to rise. Countries in the Orange and Red groups have generally migrated northeast, but they have followed very
different paths. The Orange group, where the turning point for dependency is either just past or not far away, is particularly heterogeneous. Malaysia experienced spectacular growth, nearly tripling its GDP per capita with a still reasonably low ratio of elderly dependency, while Thailand’s extraordinary growth was accompanied by particularly rapid aging, with demographic ratios approaching one elderly for seven working age adults (14%). China has grown fast but from an even lower base; its rate of elderly dependency is not far behind Thailand’s. At the high end of the spectrum, Red countries have continued their prodigious growth, all the while doubling their rates of elderly dependency. South Korea multiplied its GDP per capita by a factor of nearly 5, while Singaporeans grew to rank fifth richest nation in the world in 2010, measured in per capita income. At the helm of the aging countries in the world, Japan’s per capita income grew by three quarters over the period, despite having the oldest population in the world.

Figure 49: Getting old before getting rich?
(GDP per capita and elderly dependency ratios in EAP, 1980-2010)

Source: GDP data in 2005$ Purchasing Power Parity for 1980 to 2010 from the World Development Indicators, Elderly Dependency ratios calculated as ratio of population over 65 years old to population aged 15 to 64 using UN World Population Prospects (2012) data.

5.2 What paths will EAP countries take as their populations continue aging, and, for some, lead the way into unchartered aging levels? Dealing with the fiscal and economic consequences of an aging population requires supporting stronger economic growth in a sustainable way. As populations age in the coming decades the share of the working age population will progressively shrink, particularly in

Note that as only elderly dependency ratios are shown here, the patterns may not perfectly match the patterns of aging across groups. Some countries, such as Singapore, appear much younger than they are when the rest of the population age structure is taken into account. The implication is that they will be aging faster.
the Orange and Red countries. What happens to economic growth is then a function of productivity and participation. The analysis of previous sections provides an indication for what to expect. The future prospects for economic growth in the low income Green countries depends on their ability to capitalize on the demographic dividend. This relies in great measure on how much capital and human capital the large new cohorts of young workers are equipped with as they join the ranks of the workforce. In the middle, aging in the Orange countries will accelerate at much lower income levels than their Red neighbors did three decades ago. The impact on the size and productivity of labor as their populations age will be crucial, as these could jeopardize their chances of converging with the Red group, in particular in some countries such as Thailand or China where the population is already quite old. Finally, as the Red countries continue aging and their workforces begin to age and, for some, to shrink, will their spectacular past growth rates grind to a halt?

5.3 The decomposition of GDP per capita and scenario analysis which follow illustrate in a very simple way the economic impact of aging in the recent past and what can be expected in the future under baseline and best case scenarios. This exercise has three parts: first, a decomposition of the past effects of aging from 2010 to 2040; second and third, two simple scenarios are constructed to project GDP per capita growth from 2010 to 2040 under a “business as usual” case and a “best case” scenario. The scenario exercise is conducted using data for Indonesia, as a representative of the Orange group, and for Japan, iconic as the oldest group in the region and the world. In the backward looking part, the historical growth rate in real GDP per capita is broken down into four component growth rates: growth in the share of population aged 15 and over, in the labor force participation rate, in the employment rate, and in labor productivity (see box 4 below for details on the methodology). The forward looking scenarios are then constructed. The simple “baseline” scenario aims to capture the impact which aging could have in the absence of any intervention or behavioral adjustments. In some sense, it is a “worst case” scenario, as it makes no space for adjustments which might reasonably be expected, such as rising LFPR or increasing productivity at older ages as health and education improve. In order to construct this scenario, the age and gender-specific labor force participation rates are assumed to remain at their 2010 level and labor productivity is assumed to grow at its 2000s rate. This is then contrasted with a “best case” scenario, which aims to present a picture of what can be expected at best if substantial labor market and behavioral adjustments occur. For these optimistic scenarios, the simulations from Chapter 3 are used, in particular the simulation which assumes convergence of female to male labor participation rates by 2040. Higher productivity growth is also assumed. For Indonesia, labor productivity is assumed to grow at the same rate as in South Korea from 1980-2010. For Japan, the 30 year average productivity growth is used.

Box 5: Scenario analysis exercise methodology

The scenario analysis illustrates the consequences of future aging for GDP growth using the cases of Japan and Indonesia. The growth rate of GDP per capita is decomposed into four components to separate the demographic forces from the labor market variables and labor productivity. Let $Y_t$ and $P_t$ be GDP (measured in purchasing power parity terms) and total population in year $t$, respectively. Then the following identity must hold true for all values:

\[
\frac{Y_t}{P_t} = \frac{Y_t}{E_t} \cdot \frac{E_t}{L_t} \cdot \frac{L_t}{W_t} \cdot \frac{W_t}{P_t}
\]
Where $E_t$ is the number of employed workers, $L_t$ the total labor force and $W_t$ the size of the working age population (above 15 years old). The first term in this equation is output per employed worker measuring labor productivity. The second term is the employment rate. The third term is the labor force participation rate, measured as the size of the labor force over the population over 15 years of age (this is the standard definition of labor force participation rate used by ILO). The fourth and final term is purely demographic, reflecting the share of the population over 15 years of age.

Applying a logarithmic transformation, then iterating for one period and subtracting yields:

$$
\left[ \ln \left( \frac{Y_{t+1}}{P_{t+1}} \right) - \ln \left( \frac{Y_t}{P_t} \right) \right] = \left[ \ln \left( \frac{Y_{t+1}}{E_{t+1}} \right) - \ln \left( \frac{Y_t}{E_t} \right) \right] + \left[ \ln \left( \frac{E_{t+1}}{L_{t+1}} \right) - \ln \left( \frac{E_t}{L_t} \right) \right] + \left[ \ln \left( \frac{L_{t+1}}{W_{t+1}} \right) - \ln \left( \frac{L_t}{W_t} \right) \right] + \left[ \ln \left( \frac{W_{t+1}}{P_{t+1}} \right) - \ln \left( \frac{W_t}{P_t} \right) \right]
$$

Which is equivalent to the initial equation in growth rates:

$$
g \left( \frac{Y_t}{P_t} \right) = g \left( \frac{Y_t}{E_t} \right) + g \left( \frac{E_t}{L_t} \right) + g \left( \frac{L_t}{W_t} \right) + g \left( \frac{W_t}{P_t} \right)
$$

The growth in GDP per capita is broken down into the growth rates of the output per worker, the employment rate, the labor force participation rate and the share of the adult (over 15) population.

5.4 Indonesia and Japan are used as case studies that illustrate the most pressing questions for the Orange and Red groups’ future. Firstly, Indonesia stands as representative of the Orange group of countries. With rapid growth in the past thirty years but from a low starting point, Indonesia’s GDP per capita in PPP terms is greater than Vietnam or Mongolia, but below China, Thailand and Malaysia. It has another decade before demographic forces turn against it, but it stands below Vietnam, Thailand and China and above Malaysia and Mongolia at approximately the same ratio of elderly dependency as South Korea in 1980. Secondly, Japan faces most pressingly the possibility of a demographic tax which threatens all countries in the Red group in the coming decades.

What if Indonesia grew productively like Korea?

5.5 Despite high labor and productivity-driven growth in the past three decades, Indonesia, as many countries in the Orange group, lags the Red countries in terms of labor productivity. Growing at an average rate of 5% per year, income per person nearly tripled between 1980 and 2010, driven by a rising share of working age people and an increasing trend in average participation in the labor force across ages. This is illustrated in Figure. The most important driver of growth, though, was labor productivity, as measured in GDP per worker, which rose on average by 4.1% annually to reach $8,600 in 2010. Comparison with Korea’s past experience gives a perspective on the catching up which Indonesia and the Orange countries need to do to converge with Red countries’ labor productivity and income per person. Indonesia in 2010 had elderly dependency rates similar to South Korea in 1980 and, with an income per person of $3,864 (in 2005 $PPP), per capita income approximately equivalent to Korea’s in 1976. But an Indonesian worker produced the same average value as a Korean worker in 1969, or 16% of a Korean worker in 2010.
5.6 In this baseline scenario, by 2040 Indonesians will have a similar GDP per capita to Korea in 1985, with as many dependents per worker as Korea in 2000. The baseline case, drawn in red in Figure, assumes labor force participation rates at all ages remain at their 2010 level so that changes in the labor force are entirely determined by changes in the age structure of the population. These changes drive average labor force participation to shrink by 0.1% annually. Productivity is assumed to grow at the same annualized rate as during the past decade. The result is that Indonesia’s income per capita will grow at a 4.1% per year, a slight decrease compared to the past 30 years.
Figure 50: In the baseline scenario, by 2040 Indonesians will have similar GDP per capita to Korea in 1985 with as many dependents per worker as Korea in 2000
(Average annual growth rate in GDP per person in Indonesia under the baseline scenario, 1980-2010 and 2010-2040)


5.7 So what if some adjustments happen in the labor supply (either automatically or through policy incentives) and productivity grows faster in the next 30 years than in the past 30 years? In order to project this “optimistic” path to 2040, the labor force is assumed to continue growing according to the high female participation scenario constructed in the “optimistic” labor projections presented in Chapter 3. Labor productivity is assumed to grow in the next 30 years at the same rate it grew in Korea between 1980 and 2010.

5.8 Under this optimistic scenario, Indonesia would still only converge to Korea’s 1995 income per capita level by 2040. Taking the aforementioned assumptions to predict the path of per capita income growth, Indonesia would reach middle-income status with a GDP per capita of just below $15,000 in 2040 (Figure ) but with a far higher share of elderly population relative to the experience of other countries. In other words, under this scenario in 2040 Indonesia would have a slightly higher income per person than Malaysian had in 2010 but would have the same age composition as Malaysia will have in 2040. This shows that, as for many countries in the Orange group (and for China and Thailand in particular), Indonesia is likely to converge with the Red countries’ population age composition far before it converges with their income per capita. This also shows that labor productivity growth will be the main driver of growth in this group of countries because they face less favorable demographic changes and have, apart from China, relatively little margin to promote growth through raising labor force participation in the next 30 years.
Figure 51: Under the optimistic scenario, Indonesia would still only converge to Korea's 1990 income per capita level by 2040
(Average annual growth rate in GDP per person in Indonesia under the optimistic scenario, 1980-2010 and 2010-2040)


Japan’s age tax?

5.9 Japan is an extreme case for the Red group of countries and a good case to study the extent of a demographic tax which they may soon all face. Demographic forces in Japan over the last 30 years have shifted the age structure of the population towards age groups with lower labor force participation. Japan’s evolution during the past 30 years is illustrated in Figure 49. Even as the over 15 population share grew by 0.4% per year, it aged substantially; in fact, the working age share of the population actually shrunk by 0.18% per year over this period. Average participation in the labor force declined by 0.3% due to a shift in the population age structure towards older age groups at which labor force participation is lower. This is mainly because at those ages workers begin to leave for retirement. In the meantime, GDP per capita growth was mainly powered by productivity growth. Labor productivity grew at a decreasing rate from a 3.92% annual growth rate in the 1980s, to 1.14% during the 2000’s, a slight pick-up from its rate in the 1990s. This resulted in an average annual growth rate of GDP per capita in Japan of 2.42% over the past 30 years.

5.10 Under a base-case scenario, population aging will drive down the labor force to population ratio (LFTP) and productivity growth, grinding Japan’s slow growth in income per capita down to a third of its past rate. Figure 49 shows the average annual growth rates from 2010 to 2040 under a baseline projection. Under this “business as usual” scenario, age and gender-specific labor force participation rates are assumed to remain unchanged at their 2010 level, so that the average change in the labor force participation rate is driven entirely by changes in the population age
structure. The UN population projections predict that the over 15 population will stabilize in the next 30 years, with a substantial rise in the population aged 65 and older, which will drive down the share of the working age population by 0.6% annually. As shown in Figure 49, these population dynamics will cause average labor force participation to drop by 0.4% per year. Labor productivity is assumed to trend as in the past decade at a 1.1% growth rate, below its 30-year average rate. Under these baseline assumptions, the Japanese will see their incomes per capita stagnate at below 1% growth, a third of its historical rate.

Figure 492: Assuming baseline participation rates and labor productivity growth trending as in the past decade, the Japanese will see their incomes stagnate

(Average annual growth rate in GDP per person in Japan under the baseline scenario, 1980-2010 and 2010-2040)


5.11 Under an optimistic scenario where women’s participation in the labor market converges to men’s participation rate over the next forty years and labor productivity growth returns to its past 30-year average rate, the effects of future aging on GDP per capita growth up to 2040 will be minimal. Labor force participation of certain underutilized population groups offers the potential for mitigating the impact of aging on participation rates. Using a projection scenario from the labor section, the labor force participation rate of Japanese women at every age is assumed to steadily converge to its male equivalent over a period of 40 years. The implication for the average labor force participation rate in Japan is illustrated in Figure 50. Rather than decline by 0.4% annually as under the baseline scenario, the average labor force participation rate would remain roughly at its 2010 level. Therefore, income per capita growth would be approximately equal to productivity growth, since all other component growth rates equal zero under this optimistic scenario. If productivity growth were to return to its past thirty year average of 2.28% per year, the growth in GDP per capita would be nearly 46 per cent larger in 2040 than under the baseline case. GDP per person would be
over $14,000 higher and fiscal pressures would be reduced as a result of an enhanced capacity to fund government services.

**Figure 503: Under an optimistic scenario, labor force participation rates of certain underutilized groups offer the potential for mitigating the impact of aging**
(Average annual growth rate in GDP per person in Japan under the optimistic scenario, 1980-2010 and 2010-2040)


5.12 **Labor market adjustments may hold the key to Japan’s continued growth by activating groups of workers which were previously not formally employed and allowing the elderly to increase the number of hours worked.** Another way to define labor productivity is in terms of output per hours worked, which permits analysis of the drivers of changes in labor productivity. In the context of this exercise, labor productivity can be further broken down into GDP per hour worked multiplied by hours worked per worker. This decomposition, not shown here, reveals that the reduction in labor productivity over the past 30 years was driven almost entirely by a decline in the number of hours worked, rather than a fall in output produced per hour worked. This reduction in the intensity of work could merely be due to preferences for more flexible work arrangements around retirement. The reduction may also be due to the structure of wage contracts in Japan which rise with seniority, effectively pricing the elderly out of the market. No matter what the main reason, a rise in the number of hours worked by elderly workers or, indeed, increased participation of groups which work longer hours would contribute to raising productivity in Japan.
Figure 54: The three country groups face very different challenges (GDP per capita (PPP 2005$), old-age dependency ratio (65+ as a percentage of the working age population) and labor productivity (GDP per employed person) as size of the bubble)


Note: The bubble size indicates labor productivity measured by GDP per employed worker in PPP 2005$)

5.13 What policy priorities for EAP countries? A few group-specific conclusions and policy implications emerge from the previous analysis of the very different challenges faced by these country groups. The typology draws attention to the contrasts in policy needs of these different country groups which face very different opportunities and challenges. While high income countries face the challenges of maintaining growth with an older population, low and middle income countries must contend with faster aging and at lower income levels. The young Green countries will enjoy favorable demographics as the youth bulge continues to feed into the labor force for the next few decades. The challenge for these countries is therefore to establish the conditions for maximum GDP growth from the demographic dividend. This involves equipping the youth with human and physical capital to raise productivity and creating the conditions for job growth. Their success in doing so will determine whether they follow the divergent paths of Thailand or Malaysia. For the Orange countries the challenges of the demographic transition create the need to find new sources of productivity growth. An effort to converge towards the regional productivity frontier will be key. They can look to the Red countries for lessons. There is a considerable amount of diversity in this group with some countries at great risk of growing old before growing rich (e.g. Thailand), especially as the aging process accelerates. For the Red countries, maintaining labor growth will be the most critical challenge. Though there are large disparities in this group, as well, these countries are closer overall
to the productivity frontier and, therefore, are without easy options for gains in terms of labor productivity.
References


International Monetary Fund. 2009. “Corporate Savings and Rebalancing in Asia,” IMF Asia and Pacific Department, Regional Economic Outlook, October. IMF, Washington, DC


Naoki, S. (2011). *Quality of Labor, Capital and Productivity Growth in Japan: Effects of Employee age, seniority and capital vintage* (No. 11036);


World Bank (2013a), Skills for Quality Jobs and Development in Lao PDR.


