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The Wide Angle

The End of Population Growth

Periodical

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Summary

- Latest census data from around the world suggests that human population will peak at around 9bn in the 2050s, almost half a century sooner than generally anticipated. In our view, global fertility will fall to the replacement rate within fifteen years. Population may keep growing for a few more decades because of momentum from the age structure and rising longevity but, reproductively speaking, our species should no longer be expanding. This would be a major turning point in the history of the human race.
- Birth rates have been low in developed countries for some time but they are now plunging in developing countries. The Chinese, Russians and Brazilians are no longer replacing themselves while the Indians are having fewer children. Moreover, the skewed gender ratio in giants China and India imply that their reproductive capacity is significantly lower than headline fertility numbers suggest.
- For most major economies, the workforce will be either stable or falling over the next three decades. East Asian countries like China, Japan and South Korea will suffer sharp declines. In contrast, India will enjoy workforce growth into the 2040s. This will have important implications for the economic geography of the 21st century.
- Aging societies will respond by extending working lives. Many readers of this report will be both healthy and working at the age of seventy.

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Background

This is the first of a newly initiated publication series called The Wide Angle. The series plans to focus on global mega-trends that are shaping the world around us. In this inaugural piece, we look at the population dynamics of the 21st century. Future articles will further explore this theme as well as others such as global consumption patterns, macro-imbalances, economic geography and so on.

Demographics and population dynamics have come back in fashion in recent years as companies and policy makers have begun to worry about the consequences of rapidly aging societies. However, till now, much of the discussion was based on data collected a decade ago. Most countries in the world collect population data through a general census at the beginning of each decade. The latest census was conducted in 2010 or early 2011 and, in recent weeks, major countries like China, India and the United States have published all or some of the data. Although the evolution of population dynamics is largely along expected lines, the pace of change has been surprisingly quick. This has important implications for how we think of the future of individual countries as well as of the human race as a whole.

The conventional view as expressed by the UN Population Division latest forecasts (published on 3rd May 2011), is that world population will hit 7 billion this year, 9.3bn in 2050 and will be over 10 billion by the end of this century [1]. It also forecasts that India will surpass China as the world's most populous country before 2025 and will peak at 1.72bn in 2060. In our view, however, world population will stabilize decades before 2100 and at a much lower level.

Take for instance the population count for China. The official census shows that the country's population stood at 1.34 billion in 2010 which is some 15-20 million lower than most demographers, including the UN, were earlier expecting[2]. Birth rates have been low in developed countries for some time but they are declining very rapidly across emerging world, especially when adjusted for the gender imbalance in some countries. As we shall discuss, even India may soon have an effective fertility rate that is close to replacement level. It looks like the human species, reproductively speaking, will stabilize by early in the next decade. Overall population will continue to grow for some time because of momentum but this will increasingly be driven by the fact that we are living longer. Thus, future population growth would not be derived from reproduction and fertility but from health and longevity. Eventually, the gains from longevity will peter out (even allowing for medical advances), and the fall in fertility would triumph[3].

Of course, there are many other changes in global demographics other than just population growth. Urbanization and migration (both internal and international) is rapidly changing where we live and work. China has witnessed an extraordinary pace of urbanization in the last two decades and the latest data shows that the urban-rural split was even in 2010. This is also true for the overall distribution of the world. Now we are witnessing the same phenomenon play itself in India and it is likely to be an urban majority country within a generation. Meanwhile, the United States too has witnessed a great deal of internal churn. Between 2000 and 2010, the South and West saw a population of increases of 14.3% and 13.8% respectively while the Midwest and the Northeast saw increase of merely 3.9% and 3.2% respectively. Michigan actually saw a population loss of 0.6% over the decade.

The sheer scale and pace of all these changes, in our view, will be an important if not dominant factor in the economic history of the 21st century. Urbanization, for instance, will radically change the economic, socio-political and ecological landscape of countries like India as cities try to absorb hundreds of millions of new inhabitants. Meanwhile, we expect China

[1] "World Population Prospects", UN's Population Division, 2010 revision (published 3rd May 2011)

[2] "World Population Prospects", UN's Population Division, 2008 revision compared with the latest numbers.

[3] It is possible that medical advances will allow people to live routinely into the 100s but it is just as possible that a global epidemic causes a spike in death rates. We have ignored such "random shocks" in the discussion.

will grapple with how to redeploy an older but better educated workforce. We expect pensions, healthcare and immigration will dominate policy debate in the West. These are already important issues but could now become an overwhelming concern.

A Brief History of Population Growth

Population grow is not a new thing and human numbers have been increasing since the species emerged in Africa around 200,000 years ago. However, the sustained population boom of the last two centuries is on a different scale from anything experienced before. In order to appreciate this, let us consider how demographics have evolved over the last two millennia. According to Angus Maddison [4], total world population stood at 231 mn in 0 AD with India accounting for 75 million and China for 57 million. At this stage, the most populous European country was Italy, at the heart of the Roman Empire, with 7 million. Germany had 3 mn, France 5mn and the United Kingdom had a mere 0.8mn (all data using present day borders).

Over the next thousand years, world population grew only marginally to 268 mn but by 1500 AD, despite wars and plagues, population had risen to 438mn. India's population at this stage stood at 110 mn and China at 103mn. From here, growth rates accelerated in Europe and in China. By 1820, even as the Industrial Revolution had taking off in Britain, the overall global population stood at 1bn with China alone accounting for 381mn. India's population had also grown but beset by internal wars and political uncertainty, it was now a distant second at 209 million. Note that at this stage, Britain's population of 21mn was more than double that of the United States.

World Population 0-2010 AD

in millions	0	1000	1500	1820	1950	2010
Germany	3	3.5	12	24.9	68.3	82.3
Italy	7	5	10.5	20.2	47.1	60.5
UK	0.8	2	3.9	21.2	50.4	62
US	0.7	1.3	2	10	152.3	309
Japan	3	7.5	15.4	31	83.5	126.5
China	59.6	59	103	381	546.8	1340
India	75	75	110	209	359	1223
World	231	268	438	1041	2524	6910

Source: The World Economy: A Millennial Perspective, Angus Maddison, OECD 2001; UN Population Division; various national census data

It was during the nineteenth century that population growth rates shifted up by an order of magnitude. Improvements in medicine, public health and in productive technology allowed mankind to dramatically lower death rates. China and India saw accelerated population growth but it was Europe that experienced the biggest gains. Despite losses from two world wars, Germany's population jumped from 25mn in 1820 to 68mn in 1950 while the United Kingdom saw its population rise from 21mn to 50mn. Note that these numbers understate the European population boom because large numbers emigrated to the Americas and to various colonies. The United States saw its population jump from 10mn in 1820 to 150mn in 1950! Similarly, Latin America saw its number rise from 21mn to 165mn.

Population growth accelerated further in the second half of the twentieth century. However, the source shifted from the developed West to the relatively underdeveloped East. We tend to think of Japan as a country of aging and declining demographics but for the twentieth century as a whole, it was a star performer. Its population rose from 45mn in 1900 to 84mn

[4] The World Economy: A Millennial Perspective", Angus Maddison, OECD 2001

in 1950 and then to 127 mn in 2000 before stabilizing. China and India, both newly formed republics in 1950, had 547mn and 359 mn people respectively. They were still the two largest populations in the world but their relative share of world population was much reduced compared to their history. Nonetheless, both countries have experienced significant expansion in the last sixty years. The latest census numbers show that India now has a population of 1.21 bn while China has 1.34bn. What is interesting, however, is that growth rates are now declining rapidly across Asia and indeed across the world.

The Fall of Fertility

A theme that is common to the latest census data for almost all countries is that population growth is slowing for almost all countries. The population growth rate of the United States during the decade of 2000-2010 was 0.9% per annum, down from 1.2% during the nineties. In comparison, Japan and Germany saw almost zero population growth during the last decade. Nonetheless, it is the emerging economies that have seen the most dramatic deceleration in population growth. China saw its population growth rate fall to 0.56% per annum over the last decade compared to a rate of around 1% in the nineties and over 2% in the sixties and early seventies. Similarly, India's population growth rate fell to 1.6% from a peak of 2.3% in the seventies. The growth rate for the last decade in Brazil was 1.1% and for Russia minus 0.4%. Note that these are averages for the last decade and the current pace is significantly lower in almost all cases.

At its simplest, demographic dynamics is about the relative relationship between birth rates and death rates. Typically, death rates fall first as people live longer due to improvements in nutrition, public health, medicine and so on. Birth rates fall more slowly when social attitudes gradually change, especially for women. The chronological gap between the two rates causes a population boom. Over time, however, the birth rate catches up and, in most developed countries, keeps falling past the level required to stabilize population. As being witnessed now in Japan, the population then ages rapidly and shrinks in size.

Let us look at how this cycle played itself out over the last two hundred years. For most of history, the years of life expected at birth were around 24-28years. This began to change in Europe from the late eighteenth century. By 1820, life expectation in the United States and many Western European countries has drifted up to 37-40 years range. It then drifted up to the 47-50 years range by 1900 and further to 65-70 years range by 1950. In contrast, the life expectancy in India and China barely budged from the pre-industrial equilibrium till well into the twentieth century. In 1950, China had a life expectation of 41 years and it may have been as low as 38 years in India. They now stand at around 74 and 65 years respectively. Both have some more scope for improvement as life expectancy is now in the late seventies or early eighties in most developed countries.

Life Expectation at Birth

(average for both sexes)

Years	1820	1950	2010
France	37	65	82
Germany	41	67	81
United Kingdom	40	69	80
United States	39	68	80
Japan	34	61	82
Russia	28	65	68
China	26	41	74
India	25	38	65
Brazil	27	45	74

Source: The World Economy: A Millenial Perspective, Angus Maddison, OECD 2001; UN Population Division

The decline in birth rates also began in Western Europe at the time of the Industrial Revolution. Many interrelated changes affected this – urbanization, attitudes, aspirations, literacy, female work participation and so on. France was the first place where this change took place. The number of births per 100 population dropped from 3.2 in 1820 to 2.2 in 1900. Other Western Europeans followed soon. Today, the birth rate per 100 stands at around 1 for most Western European countries. The United States had a much higher starting point and, despite sharp declines, still has a level higher than for most developed countries. In contrast, Japan had a relatively high birth rate of 3.24 in 1900 but now is at a mere 0.75 – one of the lowest in the world.

One useful way to think about trends in birth rates is to look at what is called the Total Fertility Rate (TFR). This is the average number of live births per woman over her lifetime. It is usually estimated by sampling women of child bearing age (usually defined as 15-44 years). In the long run, a population is said to be stable if the TFR is at the "replacement rate". This is usually said to be 2.1 births per woman but in reality only developed countries can hope to keep their population stable with such a level. For developing countries, the required replacement rate is much higher because factors such as infant mortality and maternal deaths at childbirth. Thus, the replacement level of TFR is a little above 2.3 for the world as a whole.

The TFR for most developed countries now stands well below replacement levels. The OECD average is at around 1.74 but there are countries like Germany and Japan that produce less than 1.4 children per woman [5]. According to the OECD's latest estimates, South Korea has a TFR of barely 1.15 – a level that foretells rapid aging and a sharp decline in population from the 2020s. However, the biggest TFR declines in recent years have been in emerging economies. According to the UN's population division, the TFR in China and India were 6.1 and 5.9 respectively in 1950 [6]. The ratio has now fallen to 1.8 in China due to the aggressive one-child policy and to 2.6 in India due to a steady change in social attitudes. Similarly, Brazil's TFR has fallen to 1.7 from 6.2 in 1950. These are large declines but there is reason to believe that the underlying dynamics are driving actual birth rates down even faster than suggested by the headline TFR.

Total Fertility Rate

(number of children per woman)

	1950	latest
Germany	2.2	1.4
United Kingdom	2.2	1.9
France	2.7	2
Italy	2.4	1.4
Japan	3	1.4
United States	3.5	2
South Korea	5.1	1.2
OECD average	NA	1.7
India	5.9	2.7
Russia	2.9	1.5
Brazil	6.2	1.7
South Africa	6.5	2.4

Source: Society at a Glance 2011: OECD Social Indicators; UN Population Division

China and, to lesser extent, India have skewed gender ratios. The Chinese census suggests that there are 118.6 boys being born for every 100 girls, worsening from 116.9 in 2000. Similarly, India has a gender ratio at birth of around 110 boys for every 100 girls with large

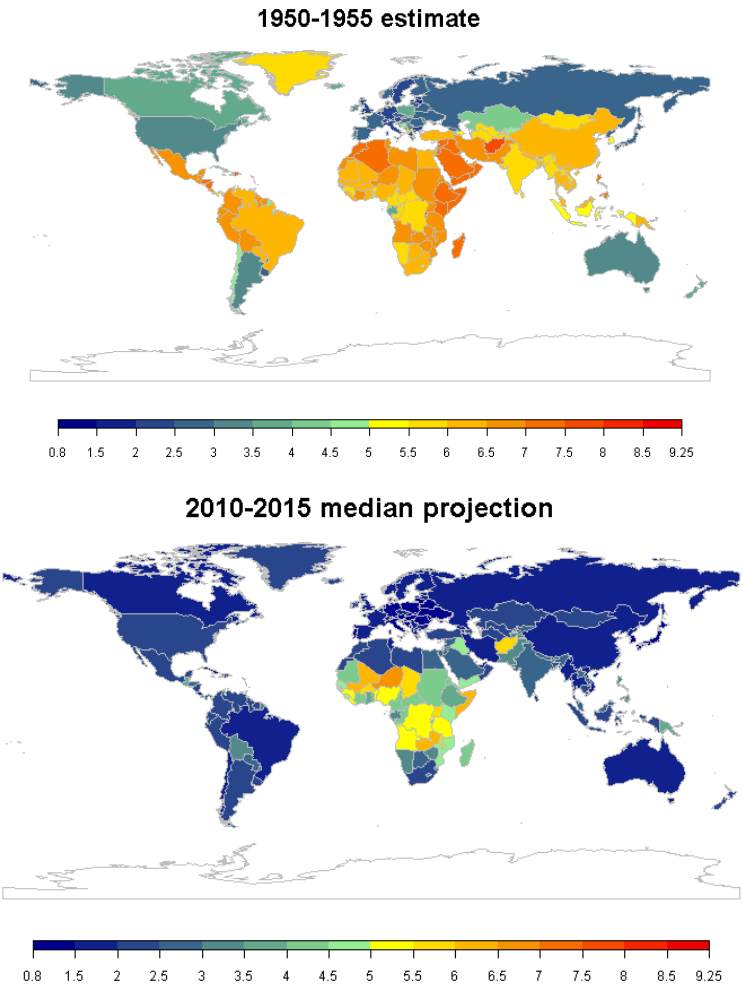
[5] Society at a Glance 2011: OECD Social Indicators

[6] UN Population Division estimates

regional variations. Compare this with the "natural" ratio of 105 boys per 100 girls (notice that even the natural ratio is not exactly 1:1). A cultural preference for boys is usually held responsible for the deviation. Since it is women who give birth and not men, the future scarcity of women implies that the effective reproductive capacity for both countries is below what is suggested by the unadjusted TFR reading. After making the adjustment for the gender imbalance, China's Effective Fertility Rate (EFR) is around 1.5 while that for India is around 2.45 – both below what is widely discussed[7]. In other words, the Chinese are already far from replacing themselves while the Indians are only slightly above the replacement rate[8]

If we make the same adjustment for the world's fertility rate, we now have an EFR of around 2.4 which is almost at the replacement rate. In our view, the human race will no longer be replacing itself by the early 2020s. Population growth will continue for a few more decades because of momentum from the age structure and people living longer but, reproductively speaking, our species will no longer be growing. This will be one of the most important turning points in history.

World Total Fertility Rate Map



Source: UN Population Division

[7] Some demographers are of the view that China's actual TFR is below the official number of 1.8. Most put it at around 1.6 which would imply an effective fertility rate of 1.3

[8] Another way to express the same point is to use the Net Reproductive Rate (number of daughters born to each woman). For China, this is now around 0.75 while it is 1.06 for India.

Urbanization and Migration

Urbanization is the spatial manifestation of the process of economic development because all development is essentially about shifting people out of subsistence farming into other activities. This is why virtually all present-day developed countries have been through a phase of urbanization. As the Industrial Revolution was taking off in 1800, the share of urban population stood at England and Wales stood at 20% of total population[9] . In relatively backward Germany, the share was barely 5.5% while it was only 3.8% in China. Industrialization in western Europe caused urbanization and large-scale rural-to-urban migration and, by the last decade of the nineteenth century, Britain had an urban majority of 62% and newly industrializing Germany was at 28%. China's had barely budged to 4.4%.

The world's urban population exceeded the rural for the first time in 2010. Most high-income and many middle-income countries are now overwhelmingly urban. The UK is 80% urban while the US is 82% urban[10] . There some interesting regional/national patterns. In general, Latin America is much more urban that one would expect for its level of development. Brazil and Argentina, both middle income countries, are 86% and 83% urban. Similarly, Russia is 73% urban. In contrast, rich Japan is only 67% urban with disproportionate share of its urban population concentrated in a single city, Tokyo.

Urbanization Rates Since 1800

% total Population	1800	1890	1950	2010
United Kingdom	20.3	61.2	79	79.6
Germany	5.5	28.2	68.1	73.9
Italy	18.3	21.2	54.1	68.4
France	8.8	25.9	55.2	85.3
China	3.8	4.4	11.8	49.9
Japan	12.3	16	34.9	66.8
India	3.4	5.4	17	33

Source: The World Economy: A Millennial Perspective, Angus Maddison, OECD 2001; World Urbanization Prospects 2009; Deutsche Bank estimates

The 2010 census data shows that China's urban population is 666 million or 50% of the overall population, an increase of 14 percentage points since 2000 on top of the 10 percentage point increase in the 1990s. In contrast, India is still overwhelmingly rural. The preliminary data for India's latest census does not yet provide data on urbanization but it is likely that the proportion will have risen to around 33%, up from 28% in 2001. Moreover, the process is gathering pace and we expect India to have an urban majority by 2040. This implies that urban India will have to absorb more than 300 million additional people. Note that urbanization has a large impact on fertility. The TFR for urban India is already below the replacement at 2.1 and, therefore, acceleration in urbanization will further dampen the country's population trajectory.

In addition to the rural-urban migration, the latest data also shows the extent of internal and international migration. For instance, the proportion of population living in eastern China rose 2.4 percentage points to 38% of overall population while western and central China lost 1 percentage points each. In fact, the number of migrant workers is now estimated at 221mn indicating that one in six Chinese is now living away from his/her registered home. India, too, is going through a similar change although the process is still its infancy. We do not have detailed census data yet but, in general, we can see how migrants from the eastern half of the country are moving to the western half. Thus, Delhi, Mumbai and Bangalore are now full

[9] "The World Economy: A Millennial Perspective", Angus Maddison, OECD 2001

[10] There are some definitional issues here about what constitutes "urban". By some definitions, the US is 91% urban.

of migrants from Bihar, West Bengal and the northeast. In addition, there are significant numbers from neighboring countries who also live and work in India.

Interestingly, the regional changes are just as dramatic for some developed economies. The US is particularly vivid example. The populations of Arizona and Nevada have jumped 25% and 35% respectively between 2000 and 2010[11] . Even populous states like Texas (up 21%) and Florida (up 18%) have seen demographic shifts that we usually associate with high growth emerging markets. In contrast, Michigan lost 0.6% of its population and Louisiana saw a paltry 1.4% increase over the decade. This shows the extent to which regional socio-economic dynamics in the US vary widely. Thus, the aggregate view of the US misses the point in many ways.

Internal and international migration is a major trend in Europe as well. According to the European Commission, The EU-27 member states host some 20 million non-EU nationals in addition to the 5mn non-nationals who have acquired EU citizenship since 2001. A further 10 mn EU nationals live in another member state. The European Commission estimates that persons with at least one foreign-born parent will account for more than a third of EU-27 population by 2060. Given the age structure, an even larger proportion of the workforce will be of foreign descent[12].

Implications for Global Population & Labour Supply

As already mentioned, the conventional view as expressed by the UN's population division's latest projections suggest that world population will rise from around 7 bn in 2011 to 9.3bn in 2050 and then further to 10.1bn by 2100[13] . This is based on two expectations (a) global life expectancy will rise from the current average of 68years to 81years (i.e. matching the best developed countries of today); (b) all countries will converge on replacement level fertility. Even if we accept the first assumption, the second assumption is somewhat unreasonable given that no major country thus far has stabilized its fertility rate at the replacement rate. Even France and Sweden, much touted for having pushed up birth rates in recent years, have not yet sustained replacement levels. Thus, the assumptions are akin to saying that we expect everyone on the planet will live as long as the present-day Japanese but with Indian fertility rates and Scandinavian gender ratios. Of course this is a possible outcome and perhaps even an ideal, but unclear if it should be taken as the likeliest. As shown by the recent experience of Japan and South Korea, birth rates can often fall precipitously as a country becomes developed.

The problem with forecasting over long periods of time is that very small differences in fertility rates can cause very different outcomes over time. For instance, if the global fertility rate converges to 1.6 (the present day European average), the UN's own model shows that world population would hit 8.1bn in 2050 and then drop to 6.2bn by 2100. This is 800mn below current levels and 4bn below the UN's central forecast. Given the sharp declines in fertility that we are witnessing in emerging markets, this scenario is no less likely than the median view of the UN's demographers. Our view is that the likeliest scenario is somewhere in between with the world population stabilizing at around 9bn in the late 2050s and then declining. India will still bypass China in the 2020s to host the single largest human population but it will stabilize at around 1.55bn in the early-2050s. This is a full decade and 170mn below the UN's baseline view. Changing attitudes, rising literacy and, most importantly, urbanization will play a key role in lowering birth rates in the country over the next few decades.

[11] "Population Distribution and Change 2000 to 2010" , Paul Mackun and Steve Wilson, March 2011, United States Census Bureau.

[12] "Demography Report 2010", European Commission 2010

[13] "World Population Prospects: 2010 Revision", released on 3rd May, 2011.

What does all this mean for the world's labour supply? No matter what one thinks about long term fertility, there are several things that are clear from the existing age-structure. For most major economies, the labour force (i.e. defined as those of working age 15-64years) has already peaked or is close to peaking. Germany, Japan and Russia already have a declining workforce. Russia has the additional and very unfortunate problem of high death rates among working-age males. The life expectancy for men in Russia is 62 years compared to 74 years for women. Brazil will see significant workforce growth this decade but it will peak by the late 2020s before declining. The US will be one of a handful of developed countries with a growing workforce but this will be based partly on continued immigration. Even this may not be as easy as in the past because many of the source countries are growing richer and are themselves seeing rapid declines in birth rates.

The aging of China is probably the fastest in history. The head of China's National Bureau of Statistics, Ma Jiantang has been quoted saying that the 2010 census showed that the share of population aged 14 years or below is now 16.6%, down 6.3 percentage points from 2000. This is a very sharp drop and will show up in workforce growth in the next decade. Indeed, China's workforce will peak in the next few years and will decline through the 2020s before collapsing in the 2030s. Will relaxing the one-child policy help? In our view, it may have some positive impact in the very long run but China is already past the tipping point because of a combination of gender imbalance and a very skewed age structure. The number of women of child bearing age (15-49 years) in China will drop 8% between 2010 and 2020, another 10% in the 2020s and, if not corrected, at an even faster pace thereafter. Thus, China will have to withdraw an increasing proportion of its female workforce and "deploy" it for reproduction and childcare. Even if such social engineering was possible today, we conclude this will actually worsen the problem of shrinking labor force for decades.

Our work shows this leaves India as the only large economy that has a workforce that is growing in sufficient scale over the next three decades to balance the declines expected in other major economies. As shown in the table below, the number of people of working age in India will rise sharply over the next thirty years. Moreover, this growing workforce is getting better educated. The latest census showed that the country now had a literacy rate of 74%, far from ideal but a significant improvement from to 65% in 2001. It is beyond the scope of this report to discuss whether or not India will be able to create a policy framework that takes advantage of this demographic dividend. It cannot be denied, however, that the opportunity exists and will be in place for a long time. It is very possible that the global economic order of the 2020s and 2030s will be all about the deployment of Indian labour in the global supply chain. In developed countries, the debate will be about how to keep people working productively into their early seventies.

Global Workforce Projections

(population aged 15-64 years)

	2010	2020	2030	2040
Germany	54.4	51.6	46.2	42.6
Japan	80.9	73.4	68.8	61.1
United States	207.5	215.6	218.4	221
China	970.5	988.8	954.3	843.2
India	789.5	923.3	1026.3	1079.7
Russia	103.1	95.2	88.4	85.8
Brazil	131.7	146.5	148.8	144.6

Source: UN Population Prospects: 2010 revision; Deutsche Bank estimates

There are other countries that should also witness growing workforces in the next few decades. These include Indonesia, Nigeria, Philippines and Bangladesh. The working age population of Indonesia, for example, should rise from the current level of 162mn to peak at around 190mn in the mid-2030s before declining. Although these countries are small

compared to India's sheer scale, they provide a glimpse of where multinational companies could search for workers in future. One interesting thing about these countries is that many of them are located in Southern Asia. This may have important implications for the economic geography of the future. We will explore this in a future report. Of course, one should not write-off China entirely just because it is aging. The country is making dramatic strides in education. Between 2000 and 2010, the proportion of college graduates jumped from 3.6 to 8.9 per hundred. Thus, we are looking at a much older as well as better educated China in the coming decades. Other East Asian countries are even further down this path. South Korea, for instance, may be well educated but will see its working age population drop from today's 35mn to 28mn over the next three decades. This should determine the position of the Pacific Rim in the global supply chain.

To conclude, we think the message from the latest census data is clear. The pace of falling birth rates and aging is very fast worldwide and will become the dominant social and economic factor for the next generation. Much has been written about the implications of this for politics, pensions, health-care and immigration. A detailed discussion of these issues is beyond the scope of this report but we will revisit them in the future. However, it would not be too much to say that many of the readers of this report will be both healthy and working at the age of seventy.

Appendix 1

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