China’s Path to the World’s Largest Economy:
Limits of Extrapolations

LU Ding*

On its path to becoming the world’s largest economy, China will face many challenges and uncertainties. Entering the rank of middle-income countries, China will find it more difficult to move up further with the burdens of a rapidly ageing population, the fast deteriorating environmental conditions and rising social inequality. This paper discusses challenges China will face as its GDP growth slows down in the coming years.

CHINA HAS JUST dethroned Japan as the world’s second largest economy, a title the latter has held for much of the last four decades. On 16 August 2010, Japan announced that its nominal gross domestic product (GDP) was valued at about US$1.28 trillion for the second quarter, less than China’s US$1.33 trillion. The slow pace of Japan’s

* LU Ding is Professor and Senior Associate at the University of the Fraser Valley, Canada.
China’s overtaking of Japan has rekindled speculation on the timing of its economy becoming the world’s largest. Forecast scenarios that China will overtake the US by total economic size in the 2020s have increasingly become an important reference note for international geopolitics.

A closer look at such forecasts reveals their reliance on extrapolations of existing trends in China’s burgeoning economy. Limits of such extrapolations should not be ignored. After decades of hyper economic growth, it is becoming more challenging for China to develop beyond the middle-income level with a rapidly ageing population, increasingly stressful environmental constraints and rising social inequality.

Even going by the most optimistic forecasts, when China becomes the world’s largest economy, its per capita income and overall level of development will still be far below the level achieved by countries like Japan and the US. By early 2020s, China may still be more than a dozen of years behind Latin American countries in terms of per capita income.

The Past Trends of Catching Up

The spectacular rise of China as a world economic power is one of the most important events at the turn of the 21st century. In 1978, before launching its market-oriented reform, China, with one-fifth of the world’s population, had a total GDP that was only one-twentieth that of the US. That ranked China the 11th economy in the world.

In the three decades since then, the world’s most populated country has seen its economy continuously growing by almost 10% per annum. With that rate of growth, the size of the economy doubles every 7.3 years. China thus has increased its total GDP more than 17 folds in just 30 years.

Thanks to hyper economic growth, hundreds of millions of people have been lifted
from poverty even though income distribution has become more polarised. With a 12-fold rise in just 30 years, China’s per capita income has increased from merely one tenth of the world average to about one third of the latter in the past 30 years.

By 2008, China lifted itself from the low-income country group to the rank of middle-income countries. Meanwhile China has also become a global manufacturing hub, the largest exporter in the world market and the largest energy consumer in the world.

In total economic size, China has quickly caught up with other large economies (Table 1). It surpassed Italy to be the world’s sixth largest economy in 2000 and then Britain and France by 2005 to become the fourth largest economy. In 2008, it overtook Germany to be the third largest economy. By that time, it was widely expected that China would pass Japan to be the second largest one in 2009.

The financial crisis of 2008-2009 badly hit the global economy and slowed China’s momentum to overtake Japan. During the crisis, China chose to re-peg its currency, RMB, to the US dollar till it returned to a managed float on 19 June 2010. On the other hand, the floating Japanese yen surged about 19% against the US dollar from June 2008 to December 2009. By market exchange rates, Japan’s GDP in 2009 was US$5.07 trillion, only 3.1% higher than China’s US$4.98 trillion, thus keeping Japan on the seat of the second largest economy for a while longer.

In the first half of 2010, China’s GDP grew at an annual rate of 11.9% and 11.1% for the first two quarters while Japan’s grew only 4.6% and 0.4% respectively. The International Monetary Fund (IMF) has forecast that China’s economy will grow 10.5% in 2010 while Japan will only grow 2.4%. Japan has thus been finally overtaken by China by total GDP size in 2010. On 30 July 2010, Yi Gang, China’s deputy governor of the People’s Bank of China, became the first high-level Chinese official who acknowledged this milestone event.

The measurement of the size of an economy by GDP in US dollar terms at market prices is subject to denomination of exchange rates, which fluctuate over time. To smooth the effects of fluctuations in prices and exchange rates, the World Bank uses a special

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank in the world</th>
<th>As a Percentage of the US</th>
<th>Overtaken country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>11th</td>
<td>&lt; 8%</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>6th</td>
<td>12.04%</td>
<td>Italy</td>
</tr>
<tr>
<td>2005</td>
<td>4th</td>
<td>17.53%</td>
<td>Britain, France</td>
</tr>
<tr>
<td>2008</td>
<td>3rd</td>
<td>26.68%</td>
<td>Germany</td>
</tr>
<tr>
<td>2010</td>
<td>2nd</td>
<td>31.35%</td>
<td>Japan</td>
</tr>
</tbody>
</table>

Note: Economic size is measured by Gross National Income, Atlas method (current US$).
The percentage for 2010 is estimated.
Source: World Bank
Atlas method of conversion: This applies a conversion factor that averages the exchange rate for a given year and the two preceding years, adjusted for differences in rates of inflation between the country, and the Euro area, Japan, the United Kingdom, and the United States.

Figure 1 shows gross domestic products (GDP, current US$) and gross national income (GNI, Atlas method) of both China’s and Japan’s as percentage of the corresponding US levels. Currently, the size of the Chinese economy or the Japanese economy is about one-third of US size.

It is also noteworthy that the Japanese economy was widely expected by the pundits in the late 1980s to soon overtake the US as the world’s largest economy. It once reached 70% of the US size in 1995 but has since deflated sharply vis-à-vis the US economy, due to its much slower growth in the past decade.

**FIGURE 1 NOMINAL GDP: CHINA AND JAPAN AS PERCENTAGE OF US**

Sources: World Bank and IMF
An alternative way to measure the size of an economy is by purchasing power parity (PPP). A PPP GNI or PPP GDP is computed by converting its value to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI or GDP as a US dollar has in the United States.

Since China’s domestic prices for most goods and services have been much lower than those in the US, its PPP GDP or PPP GNI has generally appeared much higher than its nominal GDP or GNI. As shown in Figure 2, by PPP GDP, China surpassed Japan in 2002 when its economy reached the size equivalent to 35% of the US economy. Now the size of the Chinese economy, measured by PPP GDP, is over 60% of the US economy.

**FIGURE 2  PPP GDP: CHINA AND JAPAN AS PERCENTAGE OF THE US**

Sources: World Bank and IMF

**Extrapolating China’s Economy from the Past**

Various projections have been made to estimate the timing of China becoming the world’s largest economy. As early as 1997, the World Bank published a report to prognosticate about China’s rise in the 21st century as a world economic power. More recent projections have been made by Price Waterhouse Coopers, the World Bank China Office, Goldman Sachs, etc. All these recent reports predict that China will overtake the US to become the world largest economy in the 2020s.

Forecasts of this kind are made by extrapolating past and existing trends. For instance, given the relative sizes and the GDP growth rates of China and the US in the past 10 to 20 years, one can easily speculate how the two economies would compare with each other should the past growth trends continue.

Table 2 illustrates such an exercise for three hypothetical scenarios under the naïve assumption that China will keep growing at 9.5% annually and the US will grow by
2.5%, like they did in the past two decades. Under this assumption, China will overtake the US in PPP GDP by 2017. If its currency appreciates by two percent annually up to 2020, China’s GDP will exceed the US level by 2023. A faster appreciation, say three percent per annum, will bring the event earlier to 2021. Without any appreciation, the takeover will happen around 2026.

A much cited recent forecast is made by the World Bank China Office, *China Through 2020 – A Macroeconomic Scenario*. It looks into both the supply side and demand side of China’s economic prospect. On the supply side, the report uses the standard growth accounting framework, a Cobb Douglas production function, to project potential output as a function of capital stock, employment and total factor productivity (TFP). Several “mainstream assumptions” are made:

- The contribution of investment and capital accumulation to growth remains high.
- Employment is projected by the working population (age 15 to 64) based on 2008 UNPD projection. Labour supply behaviour and labour market policy remain broadly unchanged.
- Human capital per worker will continue to rise gradually with the pace which has increased since 2005.
- TFP growth will moderate to a still relatively high rate, thanks to human capital rise and capital accumulation.

By these assumptions, the report projects the potential output growth rate to moderate in the coming decade: 7.7% in 2015 and 6.7% in 2020 from the current 10% per annum.

On the demand side, the World Bank report makes the following assumptions:

- Private consumption will grow in line with real household income, thanks to urbanisation and expected increase in government spending on health, education and social security.
- Global market share of China’s exports of goods and services will rise from

<table>
<thead>
<tr>
<th>Year</th>
<th>PPP GDP</th>
<th>Nominal GDP</th>
<th>Nominal GDP</th>
<th>Nominal GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Without RMB</td>
<td>RMB appreciates</td>
<td>RMB appreciates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appreciation</td>
<td>2% annually up to 2020</td>
<td>3% annually up to 2020</td>
</tr>
<tr>
<td>2009</td>
<td>61</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>2017</td>
<td>103</td>
<td>58</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>2021</td>
<td>135</td>
<td>75</td>
<td>93</td>
<td>104</td>
</tr>
<tr>
<td>2023</td>
<td>154</td>
<td>86</td>
<td>107</td>
<td>119</td>
</tr>
<tr>
<td>2026</td>
<td>188</td>
<td>105</td>
<td>130</td>
<td>145</td>
</tr>
</tbody>
</table>

Note: Percentage figures for 2009 are based on the World Bank and IMF statistics.
nine percent in 2009 to 11.6% in 2015. Processing imports are to grow 2.8% slower than processing exports as they did in 2004-2008.

- Real normal (non-processing) imports are to grow broadly in line with domestic demand.

Based on the above assumptions, GDP growth will gradually slow down from 9.5% in 2010 to 7.9% in 2015. Taking demand and supply together, actual GDP growth will be as fast as potential GDP and actual output will be close to potential output.

The World Bank report thus confirms that China’s total GDP in PPP terms would surpass that of the US by 2020. As for GDP in current prices and market exchange rates, the timing of overtaking depends on how fast China’s real exchange rate (RER) appreciates.

The World Bank report observes little trend appreciation in China’s RER since the end of the 1990s. Given the fact that China’s surplus labour is likely to be exhausted soon and the labour supply is reaching the so-called Lewis turning point (when labour surplus turns to labour shortage), it is expected that China’s RER poses to rise, either by further appreciation of its currency or by the rise in real wages, or by both.

The World Bank report projects two scenarios: (a) China will overtake the US as the largest economy in 2029 if its RER appreciates at 0.8% per annum to 2020; (b) China will overtake the US in 2023 if its RER appreciates at three percent per annum to 2020.

The other two influential forecasts made by Price Waterhouse Coopers and Goldman Sachs by and large use a similar analytical framework and extrapolate from past and existing trends. Only technical details and specific assumptions differ. The results of these projections are strikingly similar: The Price Waterhouse Coopers report predicts the takeover year to be 2025 while Goldman Sachs envisages the timing to be 2027. Both are within the ranges of the two scenarios outlined in the World Bank report and not too different from the linear projections in Table 2.
Limits of Extrapolations

One must interpret the results of these projections with caution. Extrapolation from past trends may have serious limits. A major limit lies in the projection model’s simplified assumptions.

A key assumption in the World Bank report is to use the working age population (aged 15 to 64) projected by United Nations Development Programme (UNDP) as a proxy for employable labour supply. It also assumes that labour supply behaviour and labour market policy will remain broadly unchanged. Based on this assumption, output is a function of the working age population.

In reality, between output and working age population, there are several links. Output is produced by employees. Of the working age population, only those who participate in the labour force are employable. Of those employable in the labour force, only some will be productively employed. Of those productively employed, productivity may vary.

By UNDP projection, China’s total labour force will peak around 2015 at about 998 million and will remain at a plateau through 2020s before falling to 983 million by 2030. What had not been taken into account in the model were the falling labour participation rates for both genders.

As shown in Figure 3, both China’s male and female labour participation rates have declined considerably since 1990. China’s labour participation rates are likely to fall further as its population ages and average income rises, a trend observed in the much lower participation rates in its richer and older neighbouring societies like Japan and Hong Kong.

China’s population is also ageing twice as quickly as India’s. As Figure 4 shows, China’s median age has already reached 32 years old around 2010, which is about 10 years older than India’s. This implies that the labour force median age must have already risen to around mid-40s. With further ageing of the population, the labour force will get

---

**Source:** World Bank
older too. Since above middle-age employees tend to be over-paid for their declining productivity, the overall labour force productivity will inevitably be compromised. That may offset some, if not all, of the assumed productivity gains from human capital improvement in the World Bank report.

It is also too simplified to assume that “labour market policy will remain broadly unchanged.” A major change in labour market policy in recent years is the Labour Law enacted in January 2008. Its impact on labour conditions in China is still unfolding. The recent spate of labour protests and the consequent rise of minimum wage rates in more than a dozen provinces clearly signal that China’s labour market is in a transition to an era of higher labour costs. This will surely accelerate the rise of RER.

Although an accelerated rise of RER may inflate China’s GDP at market prices vis-à-vis the US economy, its negative impact on external demand for Chinese output should not be ignored. Higher RER will make products and parts made in China more expensive and imports of goods made elsewhere relatively cheaper. It will therefore slow (or even reverse) the expansion of global market share of China-exported goods and services, weakening an important assumption in the World Bank report.

For the same reason, a faster appreciation of RER also undermines the other two assumptions in the World Bank report, i.e. “processing imports are to grow 2.8% slower than processing exports as they did in 2004-2008” and “real normal (non-processing) imports are to grow broadly in line with domestic demand.” A fast rising RER is likely to reduce China’s net exports and thus lower effective demand for domestic production.

As for domestic demand, it is also not optimistic that “private consumption will grow in line with real household income, thanks to urbanisation and expected increase in government spending on health, education and social security.” The household survey
data in Figure 5 shows a declining trend of urban household consumption ratios that converges with the rural level. That trend makes it unlikely that urbanisation will raise household consumption to net income ratios. Figure 6 displays a downward trend for household consumption to GDP ratio over the years.

The aforementioned scrutiny only concerns the key assumptions of the World Bank projection. Beyond these assumptions, there are many uncertainties in China’s economic development. The same World Bank report identifies several “imbalances” in the economy, including:

- heavy reliance on investment and exports for economic growth with less focus on domestic demand, especially consumption;
- domination of industry, especially heavy industry, over services;
· rapid increase in demand for energy and other resources;
· widening income disparities, especially between urban and rural areas and between coastal and inland provinces;
· pronounced unevenness in access to basic public services across regions; and
· a mixed record in the improvement of environmental quality.

This list of imbalances illustrates the point that China has largely exhausted its extensive mode of growth that depends much on cheap labour, export expansion and extensive use of natural resources. It is running out of surplus rural labour as well as “demographic dividends.” Its unit labour cost is bound to rise as labour supply plateaus. The overall export will grow slower due to the slowing growth in high-income economies and increasing competition from low-income economies.

Given the sheer size of China’s economy and population, it is simply not sustainable for China to keep growing by consuming global natural resources at the current pace, especially now that it has overtaken the US as the world’s largest emitter of greenhouse gas and energy consuming economy. After it becomes a middle-income country, China’s chance of moving up hinges on whether it can overhaul its development mode to generate future growth more from brains rather than brawns, domestic demand rather than foreign demand, and technology rather than fossil energy.

If China trips over any of these imbalances, its pace of growth will be interrupted. Due to limits of space, only one high risk factor – water shortage – will be examined here. Woo, an eminent China observer, warned that water shortage will be the most likely factor to make China’s high growth unsustainable in the coming years.

According to E. Economy, another expert on China, two-thirds of China’s approximately 660 cities have less water than they need and 110 of them suffer severe shortages. The depletion of underground water has caused the sinking of the country’s wealthiest cities: Shanghai and Tianjin had sunk by more than six feet during the 15 years to 2004. Moreover, the aquifers in 90% of Chinese cities are polluted, more than 75% of the river water flowing through China’s urban areas is considered unsuitable for drinking or fishing, and about 30% of the river water throughout the country is unfit for use in agriculture or industry. “As a result, nearly 700 million people drink water contaminated with animal and human waste.” According a special report by The Economist, water pollution and scarcity knock 2.3% off China’s GDP annually.

Instead of going through all the uncertainties China faces in coming years, let us simply assess its growth potential by records of other comparable economies in the past 30 years (Table 3). China’s per capita GDP and population in 2008, its annual...
growth rates forecast by the World Bank for 2010-25, and its old age dependency ratio in the middle of next decade are used as benchmark for comparison in this assessment.

Data of countries (economies) with per capita GDP of no less than China’s per capita GDP in 2008 (which is US$2940 in Atlas measured terms and equivalent to US$1965 in constant year-2000 dollar) at the beginning of the 1980s, 1990s and

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,965</td>
<td>1,262,645,000</td>
<td>8.10</td>
<td>13.21</td>
</tr>
<tr>
<td>1980-1989</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td>12,474</td>
<td>5,063,100</td>
<td>7.43</td>
<td>10.64</td>
</tr>
<tr>
<td>Korea, Rep.</td>
<td>3,526</td>
<td>38,124,000</td>
<td>7.68</td>
<td>6.57</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1,997</td>
<td>13,763,441</td>
<td>5.88</td>
<td>6.40</td>
</tr>
<tr>
<td>1990-1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>15,541</td>
<td>4,660,000</td>
<td>5.54</td>
<td>15.91</td>
</tr>
<tr>
<td>Korea, Rep.</td>
<td>7,403</td>
<td>42,869,000</td>
<td>6.25</td>
<td>8.27</td>
</tr>
<tr>
<td>Chile</td>
<td>3,301</td>
<td>13,190,515</td>
<td>6.38</td>
<td>10.34</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2,779</td>
<td>18,103,341</td>
<td>7.25</td>
<td>6.18</td>
</tr>
<tr>
<td>2000-2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>5,541</td>
<td>5,388,741</td>
<td>5.69</td>
<td>16.38</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4,031</td>
<td>23,273,615</td>
<td>5.49</td>
<td>6.63</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>2,759</td>
<td>8,829,829</td>
<td>5.33</td>
<td>8.91</td>
</tr>
<tr>
<td>Peru</td>
<td>2,056</td>
<td>26,004,162</td>
<td>5.60</td>
<td>8.46</td>
</tr>
</tbody>
</table>

Note: A “comparable economy” had a population no smaller than 0.075% of the global population in the first year of the reviewed decade and had an average per capita GDP in the first three years of the decade that was no less than China’s level in 2008 in constant year 2000 US$.  
Source: World Bank, IMF
2000s were collected. Given China’s population size, only the growth experience of economies with reasonably large populations would be comparable. The cut-off population for comparable economies was set at five million for year 2008, which is 0.075% of global population. The equivalent cut-off population of earlier years was calculated with the same percentage.

In Table 3, there were only seven comparable economies selected by the aforementioned criteria which ever had an average annual growth rate higher than five percent for a decade or more. Of them, only Malaysia could make it for all the three decades and South Korea could make it for two decades. Only three economies, namely Hong Kong, South Korea and Malaysia had ever grown more than seven percent per annum for a decade, but all these three economies had a younger population (indicated by lower old age dependency ratios) than China’s in the coming decade. In particular, Malaysia’s old age dependency ratios in these decades were between 6.4 and 6.6, only half of China’s in 2015.

**Interpreting the Milestone**

According to studies by economic historians, thanks to its population size and maturity as an agricultural society, China was the world’s largest economy for centuries till the late 19th century. Its standard of living was one of the highest in most of the last millennium. China lost its status as the world’s economic superpower about 200 years after the Western industrialisation. Once it finds the right developmental model in an industrial era, it seems only natural for China to return to its global economic dominance.

Projection of the timing for China to catch up with the US in total economy size provides a useful reference note for international geopolitics and regional dialogues. However, that milestone has to be read carefully with fine notes.

**FIGURE 7   PER CAPITA GDP: CHINA AND JAPAN AS PERCENTAGE OF THE US**

*Sources: World Bank and IMF*
As shown in Figure 7, by per capita income, China is still well below the levels of Japan and the US. As noted in the World Bank report, China’s per capita GDP in 2009 was below that of Namibia and Ecuador. Even if its economy grows as projected, by 2020, China’s per capita GDP would reach about the 2008 average of Latin America and the Caribbean as well as Turkey and Malaysia. In other words, China still has some way to go before it could catch up with even Latin America in per capita living standards.

Rather than feeling exhilarated about China’s overtaking of Japan as the second largest economy, Chinese policy makers should buckle themselves to the considerable slowdown of GDP growth in the coming years. To his credit, Yi Gang, after saying that China has already become the second largest economy, quickly cautioned that with a larger base, China’s GDP growth is bound to slow down. He pointed out that the country’s environmental and energy-resource constraints have reached “an unprecedentedly stressful level” and, “[a]ccording to law of human economic growth, China’s growth has to gradually slow down.” He cast doubt on China’s ability to maintain seven to eight percent growth rate in 2011–2020 and five to six percent in 2021–2030.

What Yi did not mention is the fact that China has so far been able to maintain social stability and grapple with severe polarisation of income and wealth largely by hanging on to a fast growing economic pie. As shown in Figure 8, since the early 1980s, inequality measured by GINI index has risen to an alarming level.

A recent survey report by China Reform Foundation, *Grey Income and National Income Distribution* (2010), reveals that China’s unreported household income in 2008 amounted to 9.3 trillion yuan, equivalent to 66% of the official figure of total household disposable income. Of this huge amount of “grey income”, 80% was accrued by the wealthiest 20% of all households. Based on these results, the actual income disparity might have been much worse than the official statistics have suggested.
Once economic growth slows down, it will become much more challenging for the
government to moderate the widening gap between the rich and the poor. To prepare
for a slower growing economy, the government needs to not only overhaul the growth
model for better growth quality and efficiency but also build a more comprehensive and
effective social safety net and welfare programme.

The return to the throne of the world’s largest economy does not guarantee that
China will be able to reach the development level of Japan and the US in later decades
of this century. As displayed in Figure 8, though China’s current PPP GDP is nearly two
thirds of the US level, its greenhouse gas emission has already surpassed the latter’s.

The damage that rapid industrialisation has done to China’s environment may take
generations of efforts to repair, if possible. A rapidly ageing society only makes these
issues more complicated and difficult to handle. To avoid being trapped at a middle-
income level, China needs social political reforms to deal with its growing income
inequality and environmental degeneration as well as economic reforms to improve its
growth model. The political challenges are as large as the economic ones. ▫