Potential GDP Growth for China and India: What Growth Rate is Sustainable?[1]

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Abstract

In this manuscript, we determine the sources of historic growth for the economies of India and China. Next, we estimate potential GDP growth for each country. The study concludes that India is more favorably positioned for long-term growth than China with a higher steady state growth rate. It is a large accumulation of capital or capital deepening, rather than improvement in the efficiency of capital that is driving the Chinese economy. Growth based on capital deepening as evident in China is not sustainable over time. Growth in India, in contrast, is very balanced as all major sources of growth (capital, labor and technology) contribute significantly to growth. Most positive for India was the fact that total factor productivity (TFP) growth in India was significantly higher than in China.

Keywords: *Potential GDP, India, China, Sustainable growth.*

Introduction

Potential GDP refers to the sustainable level of output for an economy and raising the level of potential GDP is the key to increasing the income and standard of living of the population. The following factors drive economic growth in any economy:

- Raw materials: natural resources such as oil, lumber and available land (N)
- Quantity of labor: the number of workers in the country (L)
- Human capital: education and skill level of these workers (H)
- Information, Computer and Telecommunications (ICT) capital: computer hardware, software and communication equipment (K_{IT})
- Non-ICT capital: transport equipment, metal products and plant machinery other than computer hardware and communications equipment, and non-residential buildings and other structures (K_{NT})
- Public capital: infrastructure owned and provided by the government (K_P)
- Technological knowledge: the production methods used to convert inputs into final products (A) (total factor productivity)

These factors are expressed mathematically in the production function as:

$$Y = A\,F(N, L, H, K_{IT}, K_{NT}, K_P)$$

Growth accounting measures the contribution of each of these factors to the economy. A country's growth can be analyzed by accounting for what percentage of economic growth comes from each of the above factors. The study employs the growth accounting framework to examine the factors driving long-term growth in the Indian and Chinese economies and is organized as follows: Section 2 examines the approaches used to estimate long-run economic growth. Section 3 looks at sources of growth for India and China. Finally, Section 4 estimates long-term growth for the Chinese and Indian economies. A summary and conclusion complete the study.

Putting it all together: Estimating Potential GDP

There are three approaches used to estimate potential GDP. First, the growth accounting equation is used to measure potential output. Potential GDP (Y) is estimated using Equation 1 with trend estimates of labor (L) and capital (K) and a estimated as one minus the labor share of GDP. The challenging task is estimating the growth rate of TFP (A), which, by definition, is a residual in the growth accounting equation.

$$\Delta Y/Y = \Delta A/A + a\Delta K/K + (1-a)\,\Delta L/L \qquad (1)$$

[1] This manuscript applies the empirical models presented in the earlier manuscript published in the last issue, and computes the potential GDP metrics.

An alternative method of measuring potential GDP is the labor productivity growth accounting equation. It is similar to the growth accounting approach but is simpler and models potential GDP as a function of the labor input and the productivity of the labor input. It avoids the need to estimate the capital input and the difficulty associated with computing total factor productivity. The disadvantage is that it incorporates both capital deepening and TFP progress in the productivity term in a way that can be difficult to analyze and to predict over long periods of time. Under this approach, the equation for estimating potential GDP is

Growth rate in potential GDP = long-term growth rate of labor force
+ long-term growth rate in labor productivity (2)

Thus, potential GDP growth is a combination of the long-term growth rate of the labor force and the long-term growth rate of labor productivity. If the labor force is growing at 1% per year and productivity per worker is rising at 2% per year, then potential GDP is rising at 3% per year.

Finally, based on the neoclassical growth model, the steady state or equilibrium sustainable growth rate of output per capita (= growth rate of capital per worker) is a constant which depends only on the growth rate of TFP (θ) and the elasticity of output with respect to capital (a). Adding back the growth rate of labor (n) gives the sustainable growth rate of output.

$$Growth\ rate\ of\ Output\ per\ capita = \frac{\theta}{1-\alpha} \qquad (3)$$

$$Growth\ rate\ of\ Output = \frac{\theta}{1-\alpha} + n$$

Factors Driving Growth in China and India

Long-term sustainable growth is determined by the rate of expansion of real potential GDP. As discussed earlier, economic growth accounting allows us to decompose GDP growth into three components which are the contribution from labor, capital and TFT. Exhibit1 provides data of the sources of output growth for China and India. GDP growth in China and India is essentially unchanged between 1995-2005 and 2006-2016. However, the sources of growth for China and India are significantly different. China's economy is highly dependent on business investment as capital contributed 6.5% points to the GDP growth rate of 7.2% in the period 2006 to 2016. China also experienced a sharp fall in the contribution from innovation as TFP declined between the two periods. In the neoclassical framework, the sustainability of Chinese growth is highly questionable.

Growth in India, in contrast, was very balanced as all three sources of growth contributed significantly to growth. Most positive was the fact that TFP growth was a robust 1.5% between 2006 and 2016 which was significantly higher than the 0.3% TFP growth in China.

Exhibit 1
Sources of Output Growth for China and India

Input	Contribution:1995-2005	Contribution: 2006-2016	Change
China			
Labor	**0.7%**	**0.4%**	**-0.3%**
Labor Quantity	0.5%	0.2%	
Labor Quality	0.2%	0.2%	
Capital/Investment	**5.6%**	**6.5%**	**0.9%**
Non-ICT Capital	4.5%	5.1%	
ICT capital	1.1%	1.4%	
TFP	**1.5%**	**0.3%**	**-1.2%**
Total: GDP growth	**7.8%**	**7.2%**	**-0.6%**
India			
Labor	**1.2%**	**1.2%**	**0.0**
Labor Quantity	1.0%	0.6%	
Labor Quality	0.2%	0.6%	
Capital/Investment	**3.2%**	**4.3%**	**2.1%**
Non-ICT Capital	2.7%	3.4%	
ICT capital	0.5%	0.9%	
TFP	**1.9%**	**1.5%**	**-0.4%**
Total: GDP growth	**6.3%**	**7.0%**	**0.7%**

Sources: OECD StatExtracts, Conference Board, Author's calculations

Labor Productivity and Capital Deepening

Exhibit 2 provides data on the growth rate in labor productivity and compares it to the growth in total factor productivity for China and India. Labor productivity growth depends on both capital deepening and technological progress. The contribution of capital deepening can be measured as the difference between the growth rates of labor productivity and total factor productivity. For example, from 2006 to 2016, India's labor productivity grew by 5.9% per year, of which 4.4% (5.9 – 1.5) came from capital deepening. The larger the difference between the productivity growth measures, the more important capital deepening is as a source of economic growth. However, as we discussed previously, growth in per capita income cannot be sustained perpetually by capital deepening.

Exhibit 2 also provides data on the *level* of labor productivity or the amount of GDP produced per hour of work. The level of productivity depends on the accumulated stock of human and physical capital and is much higher among the developed countries. For example, in 2016, the United States has had the highest level of productivity in the world, producing over $68 of GDP per hour worked. In comparison, as shown in Exhibit 2, Chinese workers produce only $14.5 worth of GDP per hour worked and Indian workers produce $9.0 worth of GDP per hour. In contrast to the *level* of productivity, the *growth rate* of productivity will typically be higher in the developing countries where human and physical capital are scarce but growing rapidly and the impact of diminishing marginal returns is relatively small.

Exhibit 2
Labor and Total Factor Productivity

	Growth in Hours Worked (%)	Growth in Labor Productivity (%)	Growth in TFP (%)	Growth due to Capital Deepening (%)	Growth in GDP (%)	Productivity Level 2016; GDP per Hour worked ($)
China						$14.5
1995-2005	1.1	6.7	1.5	5.2	7.8	
2006-2016	0.3	6.9	0.3	6.6	7.2	
India						9.0
1995-2005	2.1	4.2	1.9	2.3	6.3	
2006-2016	1.1	5.9	1.5	4.4	7.0	

Sources: OECD Statlinks, Conference Board, Author's calculations

Potential GDP growth rate for China and India

An estimate of potential GDP growth can be obtained using the growth accounting method or the labor productivity approach. The two methods should provide the same result. In general, however, the two methods are likely to give somewhat different estimates because they rely on different data inputs. The growth accounting method requires measurements of the physical capital stock and TFP. TFP is estimated using various time series or econometric models of the component of growth which is not accounted for by the explicit factors of production. As a result, the estimate of TFP reflects the average (or "smoothed") behavior of the growth accounting residual. The labor productivity approach is simpler and it avoids the need to estimate the capital input and TFP. In contrast to the estimated value of TFP, labor productivity is computed as real GDP for a given year divided by the total number of hours worked in that year, counting all workers. The cost of the simplification is that the labor productivity approach does not allow a detailed analysis of the drivers of productivity growth.

Growth Accounting Method

The production function or growth accounting method estimates the growth in GDP using Equation 1:

Growth in potential GDP = $a\Delta K/K + (1-a)\,\Delta L/L + \Delta A/A$

The inputs in the equation are given by sources of output growth provided in Exhibit 1. Using the averages for the 1995 to 2016 period, the growth in potential GDP is

China
Growth in potential GDP = $a\Delta K/K + (1-a)\,\Delta L/L + \Delta A/A$
6.0%+ 0.5%+0.9% = 7.4%

India
Growth in potential GDP = $a\Delta K/K + (1-a)\,\Delta L/L + \Delta A/A$
3.8% +1.2% + 1.7% = 6.7%

Labor Productivity Method

The labor productivity method estimates the growth in GDP using Equation 2:

Growth rate in potential GDP = long-term growth rate of labor force + long-term growth rate in labor productivity

In the above equation, the growth in total hours worked is used to measure the growth in the labor force. Using the data from Exhibit 2 and the average growth over the period 1995 to 2016, the growth in potential GDP is

China
Growth in potential GDP = 0.6%+ 6.8%= 7.4%

India
Growth in potential GDP = 1.5% + 5.1% =6.6%

Steady State Growth

Steady state growth rate in the neoclassical model is estimated by (see equation 3):

$\Delta Y/Y = (\theta)/(1-a) + n$= Growth rate of TFP scaled by labor factor share + Growth rate in the labor force

China
The labor share of GDP is 0.62 and the steady state growth rate is
0.9%/0.62+0.6%=2.1%

India
The labor share of GDP is 0.58 and the steady state growth rate is
1.7%/0.58 + 1.5% = 4.4%

The growth rate in potential GDP estimated above in both China and India is higher than the steady state growth rate. This means that the physical capital stock is below the steady state and capital deepening is a factor increasing productivity growth and the growth in potential GDP. However, China relies excessively on capital deepening and the impact of elevated levels of investments on growth will begin to diminish over time.

Conclusions

This paper suggests that India is more favorably positioned for long-term sustainable growth than China for several reasons:

1. Potential GDP growth at 7.4% is higher in China than the 6.7% estimated rate of growth in India. But most of the growth in China is due to capital deepening. Thus, it is a large accumulation of capital rather than any improvement in the efficiency of capital utilization that is driving China's economy.

2. The problem for China is that once the capital-to-labor ratio becomes high, further additions to capital have a negligible impact on per capita output and the growth in labor productivity should slow down. The neoclassical model would suggest that the impact of capital deepening will decline over time and the economy will move towards a steady state rate of growth which we estimated at 2.1%. Thus, growth based on capital deepening is not sustainable over time.

3. There has been a lack of technological innovation in China and the contribution from the labor input is declining. The lack of growth in the labor input could be offset through higher productivity derived from innovation and more efficient use of available inputs. However, this is not occurring in China. Total factor productivity (measure of the efficiency at which inputs are used) in China increased at an annual rate of 1.5% from 1995 to 2005 and then by only 0.3% from 2006 to 2016. The comparable data for India shows growth at an annual rate of 1.9% between 1995 and 2005, and at the rate of 1.5% from 2006 to 2016.

4. Without policy actions to improve innovations, potential GDP growth in China will fall to the 2.1% steady state rate.

5. India's steady state rate of growth of 4.4% is much higher than that of China.

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