



The Productivity Prize – Accounting for Recent Economic Growth among the BRICs: Miracle or Mirage?

SIEMS Issue Report

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Introduction

It was not until the beginning of the current millennium that today's emerging market economies as a group came into their own. From 1980 through 2000, they collectively grew at approximately the same pace as the rich economies of the developed world but then broke free in dramatic fashion last decade, enjoying a growth advantage of 6 percent from 2000–2009.

The four largest emerging market economies, Brazil, Russia, India and China (the BRICs), all turned in exceptionally strong growth last decade. Brazil's average real GDP growth almost doubled compared to a decade earlier. India's economic growth accelerated to an unprecedented 8% annual pace from 2003–2009. Russia's real GDP doubled and so did real incomes. China's growth remained elevated, averaging around 10%.

FIGURE 1
The Emergence of Emerging Economies*
A Recent Phenomenon (Real GDP Growth Rate)



Advanced Economies —————
Emerging Economies - - - - -

Source: IMF

Recent history, however, is littered with many examples where seemingly extraordinary rates of economic growth were not exactly what they seemed. During the first two decades after the Second World War, for example, it was widely acknowledged that the Soviet Union was outpacing the United States in economic growth. Some economists at the time had even come to admire the communist model of central planning. Unfortunately for the Soviets, the relatively rapid growth in output could be fully explained by the rapid growth in their factor inputs: a rapid expansion in their labor force, big increases in educational levels, and above all, massive investments in physical capital.

Economic growth that is based exclusively on factor accumulations, rather than on the growth in output per unit of input, or productivity, is inevitably subject to diminishing returns. It simply was not possible for the Soviet economy to continue sustaining high rates of growth in labor force participation, average education levels, and its physical capital stock that had prevailed in the early postwar years. It is estimated that overall productivity in the Soviet Union actually fell by an annual average of 1% over 30 years to 1988.¹ Without the sustenance of productivity growth, Soviet economic growth eventually faltered.

Productivity growth is the most important gauge of an economy's long-run health. Nothing is more critical in determining living standards over the long-run than improvements in the efficiency with which an economy combines its inputs of capital and labor. Most economists focus on labor productivity which is an incomplete gauge of efficiency because firms can boost output per man-hour by investing more and equipping workers with better machinery. A better gauge of an economy's use of resources is "total factor productivity" (TFP) which assesses the efficiency with which both capital and labor are used. *Once a nation's labor force stops growing and an increasing capital stock causes the return on new investment to decline, TFP becomes the main source of economic growth.*

The illusion of sustainable growth was not only limited to the command economies. The unusually rapid and protracted growth in the then Newly Industrialized Economies (NIEs) of East Asia (Hong Kong, Singapore, South Korea and Taiwan) from the 1960s until the 1980s led to widespread belief that productivity growth in these economies, especially in their manufacturing sectors, had been extraordinarily high. But seminal research (Young, 1993) showed that their economic growth was mainly due to factor accumulation and the sectoral reallocation of resources. All four nations had experienced



^{1/} These four countries, however, have seen sizeable increases in living standards since then because of faster TFP growth.

sizeable increases in their labor force participation rates, leading to natural increases in output per capita, or average living standards. In particular, however, these nations had been very rapidly accumulating capital; leading to more capital per worker, and in turn, higher labor productivity. Unlike the command economies of the communist era, factor accumulation in the four NIEs had been contributing substantially to growth because these economies on the whole allowed the increasing amounts of labor and capital to move from the less productive sectors to the more productive ones. However, when labor and capital were stripped away, there was little growth accounted for from TFP.²

Japan's dismal rate of economic growth over the past two decades is largely the result of lackluster productivity growth (TFP averaged only 0.4% from 1990-2009). As its post-World War II rate of factor accumulation began slowing, particularly capital accumulation, so did its overall rate of growth.

Part of the jump in America's labor productivity during the "new economy" era of the late 1990s reflected a sharp rise in domestic investment as a share of GDP. As this investment share returned to historically normal levels last decade, so did U.S. real GDP growth.

This brings us to the exceptional growth spurt of some of the big emerging market economies we witnessed last decade. Was much of this acceleration also largely driven by factor accumulations and sector reallocations and not by TFP gains? If so, the growth surge achieved last decade may only be temporary. Using a standard growth model, this paper will try to shed some light on this issue for each of the BRICs countries by examining their growth performance from the last decade. In turn, we hope to answer the following questions:

- Has the ongoing rise in China's investment-to-GDP ratio been driving much of its growth in recent years or is productivity still a critical engine?³
- Are the start of India's "demographic dividend" and the rapid rise in its domestic rate of investment the primary reasons why it is now the second fastest growing developing country in the world?
- Is there any chance Russia can replicate the economic gains it made during the past decade without elevated energy prices?
- Does Brazil, giddy from its economic "renaissance" during the past decade, really have good reason to be so confident of its economic future?

2/ The Economist, November 2009

3/ There have been many studies on China's productivity trends over the past several decades. Most show that TFP has been an important source of growth at least until the turn of the century. A number of recent studies, however, have expressed concern about what they perceive to be a slowing down of the rate of China's TFP growth in recent years (Kuijs and Wang, 2006; Zheng, Bigsten, and Hu, 2006).

The paper is organized as followed. Section II provides a short primer on the growth accounting identity. Section III discusses data sources. Section IV examines factor accumulation (labor and capital) among the BRICs from 2000–2009. Section V provides our efficiency analysis broken down by growths in *output per capita*, *output per worker* and *total factor productivity*. Section VI examines the *reallocation* effects (sectoral shifts in labor) of productivity gains. Section VII finishes the paper with some concluding remarks.

A PRIMER ON GROWTH ACCOUNTING



1

Growth accounting⁴ decomposes the growth rate of an economy into that which is due to increases in the amount of factors used – usually the increase in the amount of *capital* and *labor* – and that which cannot be accounted for by observable changes in factor utilization. The unexplained part of growth in GDP is then taken to represent increases in total factor productivity (getting more output with the same amounts of inputs) or a measure of broadly defined technological progress.

The growth accounting identity is given as:

$$GY = b*GK + c*GL + A$$

where *GY* is growth of real GDP, *GK* growth of the capital stock and *GL* growth of human capital. “*A*” is growth in *total factor productivity*; “*b*” and “*c*” are the shares of capital and labor in income.⁵ Employment growth is used as a proxy for the growth in human capital stock. The capital stock of an economy includes all the buildings, structures, and machinery used, in combination with labor time.

Each unit of labor can bring about more output as the capital stock per hour worked increases. But this is not the only and not necessarily the most important factor underlying economic growth. Studies by economists such as Robert Solow and Moses Abramovitz have shown that capital stock per hour worked accounted for approximately only 15% of US economic growth in the first half of the twentieth century. The remaining 85% could be attributed to technological progress.

Technological progress causes a given increase in the capital stock per hour worked to generate output more effectively. Conversely, it makes possible the attainment of any given increase in national output with a smaller increase in capital stock per hour worked. This increase in output per hour worked due to technological progress is called an increase in *total factor productivity*, which is the focus of this paper.



4/ Growth accounting was first introduced by Robert Solow (1957).

5/ The input weights are fixed across all countries at 0.35 for capital and 0.65 for labor (derived from macroeconomic growth theory).

DATA

2

Unless otherwise noted, all data was provided by the Economic Intelligence Unit (EIU). Gross Domestic Product data was rebased to 2005 constant prices and translated in U.S. dollars using the local currency unit exchange rate in 2005. Of the original 180 countries in the EIU database, only 65 had sufficient productivity data for our analysis. Nevertheless, these countries accounted for at least 90% of world GDP during our sample period (2000-2009). Employment shares for 2009 were provided by the CIA's World Factbook.

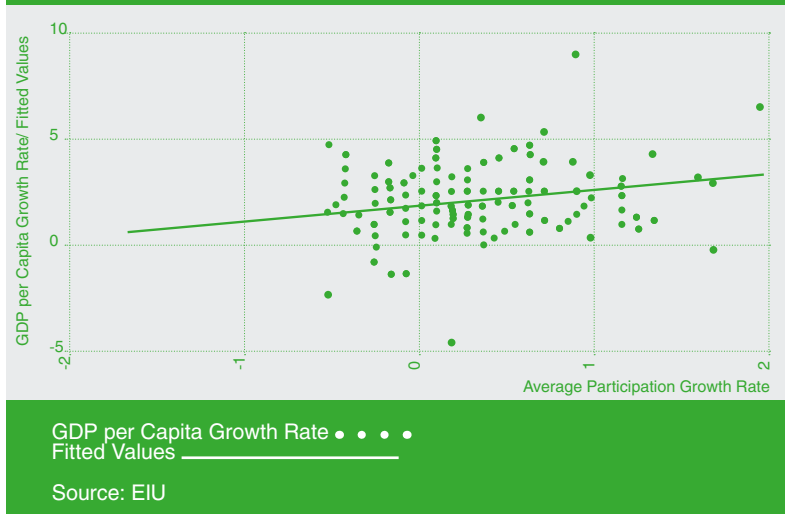
FACTOR ACCUMULATION IN THE BRICS

3

LABOR

For most developing nations, a growing labor force has been an important source of economic growth. This typically occurs when the working-age population surges and may be accompanied by a rise in the workforce participation rate (the share of the working-age population that is working or seeking gainful employment).

FIGURE 2
Changes in Participation Rates and Living Standards
(Annual 1981–2009)



As figure 2 illustrates, a rising labor force participation rate is associated with a more rapid growth in living standards. Within our sample⁶, every 1% increase in the labor force participation rate produces a 0.62% increase in the growth of output per capita. The intuition here is straightforward. As a nation mobilizes a greater share of its working-age population, then more national output is distributed across a given population.

What role did labor accumulation play for each of the BRICs last decade? Throughout the 1980s and 1990s, China's annual employment growth⁷ aver-



6/ This sample includes both developing and developed economies.

aged a very robust 2.7%. It did, however, taper significantly during 2000-2009, averaging just 1%, as the one child policy implemented during the 1970s began reducing the number of young workforce entries (China's labor force participation rate rose 2% last decade). The sharp decline in this growth rate should have, *holding everything else constant*, reduced top line economic growth by almost 2% last decade. Real GDP growth, in fact, did not slow, averaging the same 9.8% rate it did during the 1990s (it average 10% during the 1980s).

Annualized Growth in Workforce

	1990–1999	2000–2009
Brazil	2.7%	2.5%
China	2.7%	1.0%
India	2.0%	2.0%
Russia	-0.2%	0.3%

Source: EIU

Labor Force Participation Rate

	1980	1990	2000	2009
China	45%	58%	59%	61%
India	38%	38%	39%	40%
		1992	2000	2009
Brazil	–	44%	48%	52%
Russia	–	50%	48%	54%

Source: EIU

From 2003 to 2009, India experienced a marked increase in its rate of economic growth, averaging an unprecedented 8%. Interestingly, it was not faster labor accumulation among India's youthful population last decade that played a role in this economic renaissance. Its workforce grew an average of 2% last decade, the same rate it averaged in the previous two decades (its participation rate rose just 1%).

A sharp jump in Russia's labor participation rate (from 48% to 54%) overcame a shrinking working-age population to reverse the outright decline in its labor force it experience during the 1990s. Nevertheless, employment growth was very modest last decade, averaging just 0.3% per year.

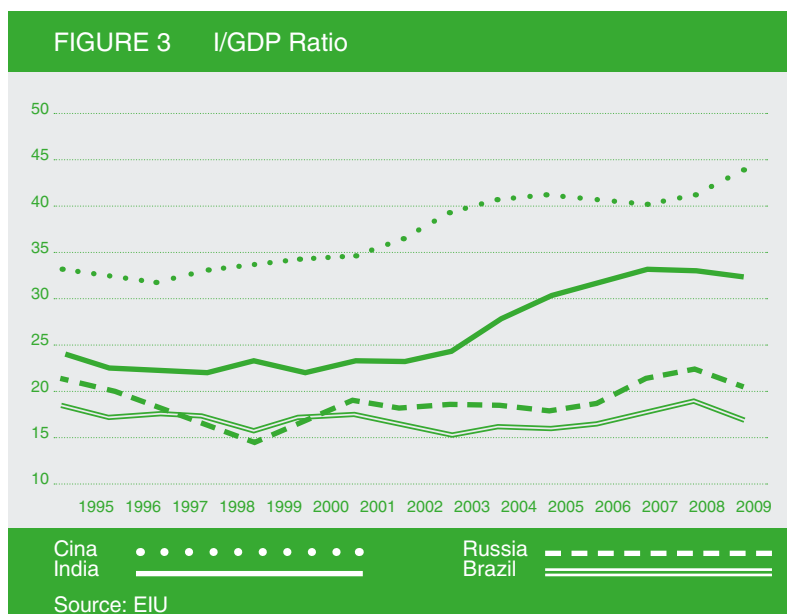
7/ Over a long period of time, employment growth is largely determined by growth in the population of labor force age.

Brazil's experienced the fastest growth in its labor force last decade, averaging a very robust 2.5%. Much of this was a result of the 4% rise in its participation rate.

CAPITAL

China is the first country that comes to mind when discussing capital accumulation. An increasing proportion of China's growth in recent years, particularly during the 2008–2009 global recession, has come from domestic investment. The question then is whether this rapid capital accumulation is beginning to diminish China's return on investment and dragging down its overall TFP rate of growth.

It is well known that China has distinguished itself over the past two decades with its exceptionally high rate of fixed asset investment. While elevated during the 1990s when it averaged almost 32% of GDP, China's investment ratio (gross investment as a share of GDP) rose to an average of 39% last decade and recently topped at an atmospheric 44% of GDP in 2009. Historically speaking, no other developing countries, not even the Newly Industrialized Nations discussed earlier in the paper come close to matching that intensity of capital accumulation.

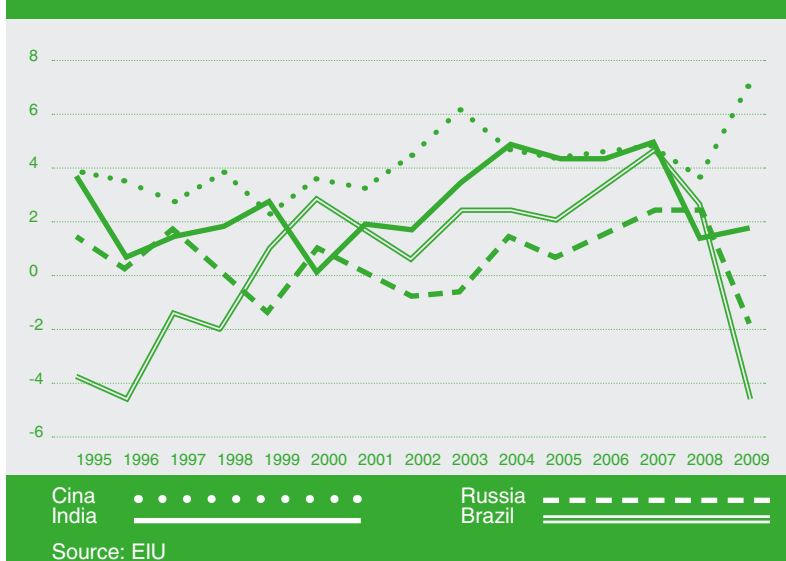


The contribution of China's domestic investment to overall GDP growth has increased over the decades. During the 1980s, when China was first building its physical infrastructure, investment spending contributed an average of 2.6% to annual growth. This rate of contribution increased to 4.1% during the 1990s and then to 4.6% last decade. Capital accumulation clearly has been contributing an increasing share to China's *top line growth*, but is it coming at the expense of efficiency?

India's improved economic performance coincided with a significant shift in the nation's domestic rate of investment. For years, India's investment rate was mired at the levels of a developed economy (high teens and low twenties as a share of GDP). Around 2003 it started rising rapidly (as a result of higher domestic savings and foreign direct investment) and now accounts for a third of India's GDP. Capital accumulation contribution to India's economic growth increased from an average of 1.6% during the 1990s to 3.5% from 2003-2009 (2.8% for the entire decade). Like China, India's new fondness for domestic investment is clearly contributing to its improved macroeconomic performance. *But is TFP or efficiency also improving?*

Running in the high teens, Brazil's rate of domestic investment (as a share of GDP) mirrors that of a mature developed country. During the 1990s it averaged 18.2% of GDP but this share surprisingly fell last decade, averaging just

FIGURE 4 Contribution of Investment to Real GDP Growth



16.7% of GDP. The efficiency of capital, however, did rise. Investment contributed 0.55% average annual real GDP growth last decade, up from just an average of 0.15% during the 1990s.

It is impossible to compare changes in Russia's rate of domestic investment over the past two decades given the rapid depreciation of its capital stock during the 1990s. Domestic investment averaged just 19% of GDP last decade, a poor rate of gross investment for a developing country.

EFFICIENCY ANALYSIS⁸

4

8/ We follow the methodology laid out in Young (1993).

To begin understanding the factors driving economic growth in the BRICs, we examine growth in *output per capita*, *output per worker* and finally growth in *total factor productivity* for a 65 country sample over 2000–2009. Within this group, 33 are currently classified as developing economies by the IMF and 32 as developed economies.

A. OUTPUT PER CAPITA

Output per capita is the broadest measure of a nation's average standard of living. Table I ranks the annualized growth in *output per capita* from our sample countries over 2000–2009.⁹

What immediately stands out is how far and away China stands from the rest of the pack. Using the sample standard deviation (1.8%) as a measure of dispersion, the average growth in *output per capita* among the 65 countries (2.6%) is almost *four standard deviations smaller* than China's (9.5%). Even Vietnam's *output per capita*, ranking a surprising second, was almost two standard deviations smaller than China's.

The 2000–2009 decade was not an aberration for China but a continuation of a trend. China's *output per capita* was equally large throughout 1990–2000 and it averaged 8.8% growth from 1980–2009. No other country in modern history has matched this growth over such duration.

India's *output per capita* (5.5%), ranked a very respectable third during the last decade. This represents a marked acceleration over the previous decade (3.7% from 1990–1999) when economic reforms were first initiated.

Perhaps most surprising is Russia's fifth place finish, averaging growth in *output per capita* of 5.2%, a breathtaking turnaround from a collapse of equal size from the previous decade. We'll discuss why Russia's productivity figures are very difficult to analyze in section C.

Brazil's growth in *output per capita* averaged a pitiful 1.8% from 2000–2009, well below the sample average of 2.6% and lower than most developed nations. It fared even worse over a longer period of time, averaging growth of just 0.5% from 1980–2009. One would have expected a marked improvement last decade given Brazil's improved macroeconomic performance.



⁹ Oil rich nations like Nigeria, Azerbaijan, Iran and Angola had experienced relatively high output per capita, per worker and TFP growth during 2000–2009 but were excluded from this sample because the acceleration in their GDP growth rates during this period was primarily the result of higher energy prices, not efficiency gains.

TABLE 1: Annual Growth of Output per Capita: 2000-2009

1	CHINA	9.5%	39	SINGAPORE	1.8%
2	VIETNAM	6.2%	40	AUSTRALIA	1.8%
3	INDIA	5.5%	41	IRELAND	1.8%
4	LITHUANIA	5.2%	42	BRAZIL	1.8%
5	RUSSIAN FEDERATION	5.2%	43	EL SALVADOR	1.7%
6	BULGARIA	5.2%	44	FINLAND	1.4%
7	ROMANIA	5.2%	45	CYPRUS	1.3%
8	SLOVAKIA	4.8%	46	NEW ZEALAND	1.3%
9	LATVIA	4.6%	47	KENYA	1.2%
10	ESTONIA	4.3%	48	SWEDEN	1.1%
11	BANGLADESH	4.1%	49	AUSTRIA	1.0%
12	MOROCCO	4.1%	50	NORWAY	1.0%
13	SRI LANKA	4.0%	51	ISRAEL	1.0%
14	POLAND	3.9%	52	UNITED KINGDOM	0.9%
15	PERU	3.8%	53	BELGIUM	0.8%
16	INDONESIA	3.8%	54	NETHERLANDS	0.8%
17	TUNISIA	3.7%	55	SPAIN	0.8%
18	DOMINICAN REPUBLIC	3.6%	56	SWITZERLAND	0.7%
19	CZECH REPUBLIC	3.3%	57	CANADA	0.7%
20	KOREA, REP. OF	3.3%	58	UNITED STATES	0.7%
21	GREECE	3.2%	59	FRANCE	0.5%
22	JORDAN	3.1%	60	GERMANY	0.4%
23	THAILAND	3.1%	61	JAPAN	0.4%
24	HONG KONG	3.0%	62	DENMARK	0.2%
25	CROATIA	3.0%	63	MEXICO	0.1%
26	EGYPT	3.0%	64	PORTUGAL	0.1%
27	SLOVENIA	2.9%	65	ITALY	-0.4%
28	TAIWAN	2.8%			
29	ARGENTINA	2.8%			
30	SOUTH AFRICA	2.6%			
31	COLOMBIA	2.5%			
32	CHILE	2.5%			
33	HUNGARY	2.5%			
34	COSTA RICA	2.4%			
35	PAKISTAN	2.4%			
36	PHILIPPINES	2.2%			
37	MALAYSIA	2.1%			
38	TURKEY	2.1%			

Source: EIU, SIEMS's calculations

B. OUTPUT PER WORKER

Our next step is to move away from measures of changes in *output per capita* to measures of changes in *output per worker* (which are closely linked to labor productivity). Gaps between both of these figures will largely reflect changes in a nation's labor force participation rate. Table 2 provides the rankings for the growth in *output per worker* for our same sample set of nations.

The movement from *output per capita* to *output per worker* knocks about 0.6% per annum off the average growth rates of the 65 sample countries (from 2.6% to 2.0%). This drop is relatively small historically speaking, implying that many nations in the sample did not experience significant increases in their labor force participation rates. Vietnam's sharp drop from 6.2% to 4.6% was a result of a fast rise in its participation rate, which rose from 49% to 56% from 2000 through 2009.

China and India are ranked first and second, respectively. Neither country witnessed a significant drop in the movement from *output per capita* to *output per worker* because their workforce participation rates did not rise significantly last decade (it rose from 59% to 61% and from 39% to 40% for China and India, respectively). With a sample standard deviation of 1.8%, the average country's growth in *output per worker* is two and four times smaller than India's and China's, respectively.

India's *output per worker* really accelerated during the past decade, rising from a respectable 3.6% in 1990s to 5.2% from 2000-2009. Interestingly, India's performance on the increase in *output per worker* recently compares favorably with that achieved by the East Asia nations during their heyday. Both India and China are now producing enormous growth in labor productivities. The question now is whether these increasing amounts of *output per worker* are creating greater TFP gains.

Russia's *output per worker* averaged 4% for the decade. The more than 1% drop reflects a rise in Russia's labor force participation rate (it rose briskly from 48% to 54%). Brazil's participation rate also rose last decade, from 48% to 52%, pushing its *output per worker* growth rate down to a dismal 0.7%. Pakistan, Kenya, Argentina and the Philippines, hardly know for the efficiency of their labor markets, all possessed higher rates of growth.

Table 2: Annual Growth of Output per worker: 2000–2009

1	CHINA	9.0%	39	AUSTRALIA	1.0%
2	INDIA	5.2%	40	KENYA	1.0%
3	ROMANIA	5.0%	41	IRELAND	0.8%
4	LITHUANIA	4.9%	42	UNITED STATES	0.8%
5	SLOVAKIA	4.7%	43	NORWAY	0.7%
6	VIETNAM	4.6%	44	JAPAN	0.7%
7	POLAND	4.1%	45	BRAZIL	0.7%
8	MOROCCO	4.0%	46	SWEDEN	0.7%
9	RUSSIAN FEDERATION	4.0%	47	UNITED KINGDOM	0.6%
10	BANGLADESH	3.7%	48	FRANCE	0.6%
11	ESTONIA	3.6%	49	SINGAPORE	0.6%
12	SRI LANKA	3.6%	50	NEW ZEALAND	0.5%
13	BULGARIA	3.4%	51	DENMARK	0.5%
14	LATVIA	3.2%	52	AUSTRIA	0.5%
15	INDONESIA	3.2%	53	ISRAEL	0.4%
16	COLOMBIA	3.0%	54	NETHERLANDS	0.4%
17	SOUTH AFRICA	2.9%	55	BELGIUM	0.4%
18	CZECH REPUBLIC	2.9%	56	GERMANY	0.3%
19	KOREA, REP. OF	2.8%	57	EL SALVADOR	0.3%
20	CROATIA	2.8%	58	SWITZERLAND	0.3%
21	HONG KONG	2.7%	59	CANADA	0.1%
22	TURKEY	2.5%	60	CYPRUS	0.0%
23	DOMINICAN REPUBLIC	2.4%	61	COSTA RICA	-0.4%
24	JORDAN	2.4%	62	PORTUGAL	-0.4%
25	ARGENTINA	2.4%	63	SPAIN	-0.4%
26	GREECE	2.3%	64	ITALY	-0.5%
27	MALAYSIA	2.3%	65	MEXICO	-0.6%
28	THAILAND	2.3%			
29	TUNISIA	2.2%			
30	PHILIPPINES	2.0%			
31	SLOVENIA	2.0%			
32	PERU	1.9%			
33	HUNGARY	1.9%			
34	TAIWAN	1.9%			
35	EGYPT	1.4%			
36	FINLAND	1.3%			
37	CHILE	1.2%			
38	PAKISTAN	1.0%			

Source: EIU, SIEMS's calculations

C. TOTAL FACTOR PRODUCTIVITY (TFP)

While measures of *output per worker* account for labor productivity, it does not give a complete picture of an economy's total efficiency because it does not properly account for capital accumulation. Workers will produce more output with more capital but eventually increasing amounts of capital will result in ever-diminishing returns for capital. Table 3 presents the rankings for average *total factor productivity* (TFP) growth rates for our sample countries, 2000–2009.¹⁰

China retains its number one ranking, with TFP growth averaging 5.2% for the decade. Interestingly, this is, in fact, acceleration from the 1990–1999 average of 4.1%. In absolute terms, no nation has matched this rate of efficiency growth for this duration during any of the post-World War II period. China's TFP growth is almost twice as fast as that of Japan's and Germany's during their peak TFP growth spurts.

While China is still clearly generating lots of economic growth from sheer capital accumulation (note the almost 4% drop from growth in *output per worker* to growth in TFP), gains in TFP accounted for a little more than one-half of China's economic growth last decade. These figures find no support for some of the recent arguments that China is experiencing a deceleration of growth in their TFP due to wasteful and excessive expansions in fixed asset investment.

Share of Economic Growth from TFP (2000-2009) (annual average)

	Real GDP Growth	TFP	Share
Brazil	3.3	0.4	13
China	9.9	5.2	53
India	6.9	2.8	41
Russia	5.4	4.8	88

Source: EIU, SIEMS's calculations

India's TFP growth averaged 2.8% for the decade (ranking it sixth out of our 65 country sample). The sharp drop-off from the robust *output per worker* of 5.2% also reflects the new importance of greater capital accumulation or deepening for the Indian economy last decade. The 2.8% TFP pace last decade



10/ TFP growth in developing economies during 2000-2009 averaged 2% versus 0.7% for the developed economies.

TABLE 3: Annual Growth of Total Factor Productivity: 2000–2009

1	CHINA	5.2	39	KENYA	1.1
2	RUSSIAN FEDERATION	4.8	40	UNITED STATES	1.0
3	LITHUANIA	3.9	41	ISRAEL	0.9
4	HONG KONG	3.1	42	CANADA	0.6
5	BANGLADESH	2.9	43	CHILE	0.5
6	INDIA	2.8	44	NETHERLANDS	0.5
7	DOMINICAN REPUBLIC	2.7	45	BRAZIL	0.4
8	INDONESIA	2.7	46	COSTA RICA	0.4
9	ROMANIA	2.6	47	SWEDEN	0.4
10	COLOMBIA	2.5	48	SLOVENIA	0.3
11	MOROCCO	2.4	49	NEW ZEALAND	0.3
12	ESTONIA	2.4	50	NORWAY	0.3
13	PHILIPPINES	2.4	51	EL SALVADOR	0.2
14	JORDAN	2.3	52	GERMANY	0.1
15	LATVIA	2.3	53	FRANCE	0.1
16	SRI LANKA	2.2	54	JAPAN	0.0
17	VIETNAM	2.2	55	SWITZERLAND	0.0
18	THAILAND	2.2	56	AUSTRALIA	0.0
19	SLOVAKIA	2.2	57	BELGIUM	-0.1
20	TURKEY	2.1	58	SPAIN	-0.1
21	CZECH REPUBLIC	2.1	59	UNITED KINGDOM	-0.2
22	TUNISIA	2.1	60	DENMARK	-0.3
23	MALAYSIA	1.9	61	MEXICO	-0.4
24	PAKISTAN	1.8	62	AUSTRIA	-0.5
25	PERU	1.8	63	CYPRUS	-0.6
26	POLAND	1.8	64	PORTUGAL	-0.7
27	IRELAND	1.7	65	ITALY	-0.9
28	TAIWAN	1.7			
29	SOUTH AFRICA	1.6			
30	KOREA, REP. OF	1.6			
31	HUNGARY	1.6			
32	CROATIA	1.5			
33	SINGAPORE	1.5			
34	ARGENTINA	1.5			
35	EGYPT	1.5			
36	BULGARIA	1.4			
37	FINLAND	1.4			
38	GREECE	1.4			

Source: EIU, SIEMS's calculations

was a 40% increase from the 2.0% averaged from 1990-1999. In other words, India added almost a full percentage point (0.8%) of real GDP growth last decade from higher TFP growth. With average real GDP growth a robust 6.9% for the decade, TFP accounted for 40% of India's growth. That is a significant increase from TFP's one-third share during 1990-1999.

These results clearly set both China and India apart from the East Asian "miracle" of the 1970s and 1980s, which was primarily based on ever growing investments in physical capital. Much of China's and India's recent economic gains are being fueled by efficiency gains in factor inputs.

Unfortunately, Russia's very robust efficiency figures (at first glance, TFP growth appears to have accounted for 88% of Russia's economic growth last decade) do not necessarily reflect productivity gains in labor and capital but largely gains in the price of energy and raw materials during the decade. The share of the oil and gas sector is estimated at 25% of Russia's GDP. Given the decade long boom in the price of hydrocarbons and precious metals (the price of oil rose sharply and almost continuously from 2003 through 2008), it is impossible to estimate how much Russia's TFP grew during this period. With factor inputs growing relatively slow during the decade, the acceleration in economic output is captured by the growth accounting formula's residual, or TFP.

Iran, for the very same reason, was thrown out of the sample set. A large oil exporter, Iran's economy festered with all sorts of efficiency problems during last decade due in part to the state's mismanagement of the economy. But TFP growth actually *accelerated* from 0.7% to 2.2%, during 1990-1999 to 2000-2009. As long as Russia's economy remains dominated by hydrocarbons, it will only be possible to evaluate secular productivity trends during a business cycle with relatively more stable energy prices.

That said, there must have been *some* increase in Russian TFP growth last decade. There was a large reallocation of resources from uncompetitive heavy industry to the service sector. There were also significant amounts of foreign machinery and equipment imported and improvements in management and labor skills. These factors, among others, must have produced some technological progress.

Brazil has become the new darling among the BRIC economies in recent years. Its macroeconomic performance has improved over the past decade. For example, its average real GDP growth rate almost doubled from 1.7% during the 1990s to 3.3% from last decade. Too bad none of this improvement came from greater efficiency. Brazil's TFP growth averaged an abysmal 0.4% last decade, down from an average of 0.6% during the 1990s. Only 13% of Brazil's economic growth over the past decade has come from efficiency gains. If the past decade's TFP trends continue in the coming years, it will be Turkey

(2.1%), Vietnam (2.2%) and Indonesia (2.7%), not Brazil, that should eventually see faster and sustaining rising standards of livings for their populations.

Examining Brazil's more recent numbers, however, reveals evidence that the Latin giant Brazil maybe in the early stages of turning around its lackluster productivity picture. Brazil's economic growth did not really begin accelerating until 2004. From 2004 through 2008 (2009 growth was impacted by the global recession), real GDP and productivity growth averaged 4.8% and 1.7%, respectively (TFP accounted for over one-third of economic growth). That represents a four-fold increase over the entire decade's average. While five years is not enough time to assess whether Brazil is beginning to embrace a "new economy", there must be some room for optimism.¹¹

^{11/} It should be noted that Brazil also benefited from higher raw material prices during the decade (e.g., - iron ore, soybeans, etc.), but not nearly to the same extent as Russia did.

THE REALLOCATION EFFECTS ON PRODUCTIVITY

5

Developing nations often experience large reallocations of resources between sectors as their economies mature. These reallocations are potentially an important source of growth for economies in which a large share of labor is underutilized in agriculture. A 2006 IMF study notes that “for the world as a whole, labor productivity in nonagricultural sectors is about *three times higher* than in agriculture.”

China has been benefitting enormously from this reallocation effect since the start of its economic reforms. In 1978 approximately 71% of the workforce was employed in agriculture but by 2000 this share had fallen to 50% and by 2009 dropped to an estimated 38%.¹² Last decade China’s industry and service sector roughly divided the exodus from agriculture. This employment reallocation had an enormous impact because industry and service productivity levels are approximately *7 and 4 times higher*, respectively, than labor productivity in the agricultural sector.

The impact of this reallocation on productivity and economic growth can be estimated by taking the growth rate in output per worker by sector and multiplying it by that sector’s total value added share of GDP. The difference between the total growth in output per worker and the sum of the sectoral contributions provides a residual measure from the effects due to resource reallocations.

Table 3 provides a breakdown of the sectoral gains from growth in output per worker from the past decade. Not surprisingly, over a third of China’s growth emanated from the industrial sector while the service sector provided more than a healthy one-quarter share. Last decade, the reallocation of labor from agriculture to industry and services contributed a staggering 2% to China’s average annual economic growth.

Sectoral Growth in Output per Worker, 2000–2009 (percent contribution to growth)

	Total	Agriculture	Industry	Service	Reallocation
China	9.0	1.0	3.6	2.4	2.0
India	5.2	0.6	1.9	1.7	1.0

Source: EIU, SIEMS’s calculations

India also experienced a large workforce shift last decade, with the share of employment in agriculture dropping from 61% to 52%. Almost all this share went into services, which now account for 57% of GDP and one-third



¹²/ SIEMS’ estimate. Last available year is 2007, when the share stood at 40.8%.

TABLE 4.
Value-Added and Employment by Industry as Share of Total

	Agriculture	Industry	Services
Value-added			
2000			
China	16%	50%	34%
India	22%	28%	50%
Brazil	7%	26%	67%
Russia	7%	33%	60%
2009			
China	9%	55%	36%
India	15%	28%	57%
Brazil	6%	26%	68%
Russia	6%	29%	65%
Employment			
2000			
China	50%	22%	28%
India	61%	15%	24%
Brazil	20%	21%	59%
Russia	15%	28%	57%
2009			
China	38%	28%	34%
India	52%	14%	34%
Brazil	20%	14%	66%
Russia	8%	29%	63%

Source: EIU, China Statistical Yearbook 2008, CIA's World Factbook,
 SIEMS's calculations

of employment. Unlike China, India's sectoral contribution is roughly equal between services and industry and the productivity levels in both sectors are approximately *six times* higher than those in agriculture. Interestingly, India's reallocation residual, 1%, contributed almost the same proportion of overall growth in output per worker as China's did last decade (19% for India and 22% for China).¹³

Having already industrialized and largely moved off the farm earlier last century, Russia's agricultural workforce share was already relatively small. With 8% and 63% of its workforce employed in agriculture and services, respectively, Russia's labor force composition already resembles that of a modern developed economy. Its share of the workforce employed in agriculture did fall during the decade an estimated 7%. Unfortunately this did not net Russia any reallocation dividend because productivity growth in agriculture has been running at a slightly faster clip in recent years than industry and services.

Brazil sectoral shares in output and employment shifted little last decade, eliminating the possibility of reallocation gains. Brazil has been experiencing a continuous shift of labor from industry into services but this is not providing a productivity boost.

CONCLUSIONS

6

The rapid pace of real GDP growth set by the world's two largest emerging economies last decade was not a mirage of heavy factor accumulations and resource reallocations (the factor component breakdowns in real GDP growth by country are provided for in the appendix). A large share was powered by efficiency gains. China's rapid growth was not just due to heavy investment and labor leaving the farm, but also to the world's fastest productivity gains. A good portion of the acceleration in India's growth has come from faster TFP.

But how is factor accumulation and resource reallocation likely to impact our two emerging giants moving forward? China is faced with a marked slowing of the increase in its working-age population. In addition to that, its workforce participation rate is already relatively high. Perhaps more important, even though rapid capital accumulation has not appeared to have diminished TFP gains in recent years, it is clear that the capital intensity of China's recent growth is not a sustainable equilibrium and must begin to taper.

That said, China still has the potential to sustain much of its economic momentum in future years by continuing to shift its agricultural workforce into the higher productivity industrial and service sectors. This ongoing shift is an important reason why China's TFP and overall growth has not been fading in recent years. With almost 40% of its workforce still in agriculture, China has some more room for reallocation gains. One-third of China's rural population, or approximately 200 million people, is expected to move into urban centers over the next two decades. It is not beyond comprehension to expect China's agricultural employment share fall to around 20% by 2030.

India has three *massive* tails winds at its back. Not only will the working-age population be growing rapidly the next twenty years, but its labor force participation rate (at only 40%), has huge upside potential, particularly for females (only 30%). India's capital accumulation also appears to be in its early stages and is expected to remain elevated (as a share of GDP) for many years. Because capital formation just recently started in India, returns on capital should remain high. And with over half its workforce still directly employed in agriculture, India has the potential to experience enormous reallocation gains over the next two decades. If TFP growth remains at current levels (approximately 3%), India could easily continue achieving economic growth of a *minimum* of 8% for a very long time.

There is one more factor, not directly discussed in the paper, which could give India additional momentum to the quality and quantity of its human capital in the coming years. While China's adult literacy rate was 94%¹⁴ in 2008

and has little room to rise further, India's stood at only 63% in 2006. It has been rising rapidly in recent years, having stood at 48% in 1991.

It's clear that labor accumulation will not be a source of economic growth for Russia in the coming years. In Russia the working-age population is expected to drop by 15 million from 2010 to 2025. Productivity gains from the reallocation of labor are also not in the cards. That leaves the necessity of attracting a much larger share of foreign direct investment if Russia wants to increase its domestic rate of investment.

TFP growth in Brazil has been anemic and rising even more slowly than in developed world. Whether the strong TFP upswing Brazil experienced the second half of last decade is the beginning of a trend remains to be seen. Looking forward, unless Brazil finds some way to significantly boost its long dormant efficiency gains, then the only way to maintain or accelerate its recent economic gains in the coming decade will be to dramatically increase its factor accumulations. For Brazil, this would have to come in the form of much greater fixed asset investment. Brazil's investment ratio (I/GDP) currently hovers around 18%, the average of many developed countries. Brazil would need to increase this to levels run by other developing nations like India (i.e., 30%-35%). This could be accomplished through sizeable increases in domestic savings and/or an increase in foreign direct investment.

The lack of TFP growth does not mean that Brazilians could not be richer years from now. The discovery of substantial oil reserves in Brazil has the potential to make the nation wealthier in the coming years assuming that the fiscal windfall is not wasted. But it must be noted that history has generally not been kind to nations who have relied solely upon their mineral endowments to build wealth. Brazil will be better off if they can build off on their very recent efficiency gains.

And lastly, (and outside the scope of this paper but worth touching upon), what one single factor or policy variable could each of the BRICs change to boost TFP growth the most dramatically over a relatively short period of time? For Brazil, it may mean implementing policies to "control" the size of their huge "informal" economy, which represents about a third of GDP. By avoiding taxes, ignoring quality and safety regulations, or infringing on copyrights, these "gray-market" companies gain cost advantages over law-abiding businesses. The results are honest companies making less money and investing less in technology and other productivity-enhancing measures.¹⁵ Russia has so many structural problems hindering its productivity it is hard to choose just

one. But one that would be relatively easy to change over the short-run would be reducing the level of state control over many of their strategic sectors (oil, gas, transportation, banking, etc). Liberalization would encourage greater foreign direct investment in these vital sectors, infusing the technological and managerial knowledge that Russia so desperately needs.

For India, it would probably be reforming its archaic labor laws that require firms to get government approval before they can lay-off more than 100 employees. This is a huge deterrent to the formation of large scale enterprises which dramatically boost output per worker because of economies of scale. For China, it would definitely be an acceleration of financial market deregulation. Despite the high returns to gross investment documented in this paper, China still misallocates an enormous amount of its savings due to a myriad of restrictions on investments, foreign exchange and capital flows. Liberalization would increase the returns to savings and that could only be unambiguously positive to overall efficiency.

Appendix

Sources of Economic Growth 2000–2009 (average annual change)

	L	K	TFP	Y
Brazil	2.3	0.6	0.4	3.3
Russia	0.1	0.5	4.8	5.4
India	1.3	2.8	2.8	6.9
China	0.1	4.6	5.2	9.9

Source: EIU

Note: Assumes the shares of capital and labor in income are 0.35 and 0.65, respectively. See section II for a primer on the growth accounting formula.

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