BARRY BOSWORTH
Brookings Institution

SUSAN M. COLLINS
Brookings Institution and Georgetown University

ARVIND VIRMANI
Planning Commission, Government of India

Sources of Growth in the Indian Economy

Optimism about the potential for India's economic growth has grown steadily in recent years. In part, this is fueled by China's example of strong sustained growth, raising the obvious question of why India cannot do as well. However, the optimism also reflects the fact that India's growth has accelerated over the past two decades. And while still well below the growth rate in China, this favorable performance contrasts with growth slowdowns in other regions. It has also enabled the emergence of a significant middle class in India. Interestingly, India's economic performance has differed from that of China and other parts of Asia in at least two dimensions. First, India's success has not been based on strong growth in the manufacturing sector and in exports. Instead, it has reflected very rapid expansion of the service-producing industries. Second, it has been associated with relatively modest levels of investment. Even incorporating recent data revisions, India's physical capital accumulation has not been impressive. And despite substantial increases in the number of Indians attaining higher education, illiteracy rates remain high.

In this paper, we build on a growth accounting framework to empirically examine these dimensions of India's recent growth. How has the growth been distributed among agriculture, industry, and the service-producing sectors? What are the major contributors to that growth: increased employment, physical capital, educational attainment, or improvements in the basic efficiency of resource use (total factor productivity)? We are particularly interested in the sources of growth in the service-producing industries. Is it sustainable or should India place greater emphasis on the manufacturing sector and the promotion of rapid growth in export markets? Throughout the analysis, we are concerned about the quality of the available statistical data.

We seek to contribute to the existing literature in a variety of ways. The growth accounting framework, combined with our emphasis on data issues, pulls together concerns that have typically been treated separately, and that do not appear to have been consistently recognized. Our updated growth accounts are based on extensive examination of the relevant underlying data series, enabling us to clarify a number of issues related to how the data are constructed. The updated accounts incorporate recent data revisions, some of which are quite large. They also provide new estimates for the contributions to overall growth from changes in labor productivity within major economic sectors versus the gains from reallocating labor and capital among the sectors. Furthermore, we have examined a variety of additional data in our analysis of the role of capital accumulation—providing estimates of the returns to schooling for human capital, and reporting on trends in sectoral saving and investment in physical capital.

The existing literature on productivity in India focuses either on the performance of the aggregate economy or manufacturing, the latter at the industry or firm level. But understanding India's evolving transformation from a primarily rural and agricultural economy to a more modern one requires analysis of both the evolution of productivity in all three key sectors—agriculture, industry and services—and the implications for aggregate productivity growth of the reallocation of resources out of agriculture to more productive activities in industry and services. This is particularly essential for India where, in contrast with the typical pattern in East Asia (including China), the primary driver for growth has been services, not industry.

Our paper fills this important gap by separating aggregate productivity growth into growth for each of the major sectors of the economy and by providing an estimate of the growth effects of factor reallocation among sectors. A key finding of the paper is that services have shown very substantial productivity growth since the early 1980s—a result in sharp contrast to that obtained for other countries at a similar stage of development. Productivity gains in agriculture and industry have been modest, which is consistent with both the findings of prior studies of India and those for other comparable countries such as Korea and Taiwan in the 1960s and 1970s. What distinguishes the Indian case is the relatively small *output* growth in industry. As a result, the sector has not played a major role in reallocating workers out of agriculture where they are underutilized.

We argue that the emphasis on business services as the driving force behind the expansion of the Indian economy is frequently overstated. Despite its extraordinary growth, the industry comprises only a small share of India's GDP and overall employment. In addition, business services

provide jobs primarily for the relatively small proportion of the workforce that is highly educated. We find some evidence that the current emphasis on high-skill services is already encountering some shortages—a bidding up of the relative wage rate for secondary and university-level graduates. Furthermore, high rates of total factor productivity (TFP) growth in the overall services sector, which includes such industries as trade, transportation and education where we would not expect to observe rapid TFP growth, raise concerns that growth of the sector may be overstated in the statistics.

In any case, India's growth expansion is not creating adequate job growth for the bulk of the population that is not particularly well-educated. Thus, it is important that India broaden the base of the current expansion by promoting programs that would increase India's attractiveness as a source of manufactured goods for the world market. The growth of the manufacturing sector would provide a strong match for the skills of the Indian workforce.

The paper also offers a discussion of two additional subjects that have an important bearing on growth and productivity: education and physical investment. On the former, we provide an empirical analysis of the returns to different levels of schooling in India. While we do find a high average return, our results suggest that returns are relatively low at the elementary levels. This is surprising compared to the results for other developing countries, and a cause for concern, given the large share of the population with little education. As we illustrate, the Indian workforce is not particularly well-educated. Illiteracy rates are high by international standards, even among the young, and we find evidence of shortages among the group of highly-educated workers (university graduates) who have done so well in recent years. India also faces significant challenges in the quality of the educational system. Thus, India needs to expand the supply of well-educated workers at the same time that it increases the demand for workers with more modest skills.

On savings and investment, we assess the quality of various estimates offered by the Central Statistical Organization (CSO) and argue that the overall rate of saving has expanded substantially in recent years. Furthermore, we conclude that the supply of private saving in India is adequate to support a significantly higher rate of growth in future years. From the perspective of physical capital formation, the problems are more concentrated in the extreme dissaving of the public sector and the apparent weakness of investment incentives on the demand side.

There is already an extensive empirical literature—often using growth accounts—that examine India's past economic growth. Many of the studies address one or more of the following topics. First, a number of analysts

have focused on characterizing India's economic performance at the most aggregate level. While there is concurrence on the fact that the growth improved during the past quarter century, researchers have reached varying conclusions on some issues such as the timing and precise magnitude of this acceleration, and the relative importance of changes in domestic policy. For example, Virmani (1997), Rodrik and Subramanian (2005) and Kohli (2006a and b) point out that growth initially accelerated during the 1980s, predating the reforms that followed the crisis of the early 1990s. Within this context, Rodrik-Subramanian and Kohli both stress the role of what they term "pro-business" reforms that began in the early 1980s. In contrast, Srinivasan (2003b) and Panagariya (2004) argue that India's growth did accelerate prior to the more substantial liberalizations in the 1990s, but that this was concentrated in 1988–91 following some initial liberalizations and furthermore, that it was driven by unsustainable increases in public expenditures and excessive foreign borrowing, thus culminating in the balance of payments crisis of 1991. There are on-going discussions over the extent to which the current growth can be maintained and various means by which it might be increased.

Second, analysts have examined the behavior of particular sectors. A number of authors have studied productivity in manufacturing—reaching a wide range of conflicting conclusions. However, as explained in detail by Goldar and Mitra (2002), differences in the findings can be largely attributed to a variety of measurement issues, such as the use of single versus double deflation to construct estimates of real growth in manufacturing value added. Goldar (2004) provides a careful recent update showing that TFP growth in manufacturing appears to have slowed in the post reform period; raising additional puzzles discussed below.[1] However, due to difficulties in measuring employment within individual industries, our analysis focuses primarily on the broader industrial sector. Additional studies that focus on the performance of agriculture and India's services sector are discussed in later sections of this paper.

Thus, this paper is comprised of four remaining sections. The next section details the construction of growth accounts for India, with considerable attention paid to the quality of the underlying data. The section following it presents and discusses the results. Section three examines a range of issues related to the role of capital accumulation in India's growth experience. It focuses first on human capital and then turns to an analysis of investment

1. Goldar and Mitra (2002) and Goldar (2004) provide extensive references to the prior research on manufacturing.

and saving behavior in India. Drawing from the preceding analyses, the final section discusses implications for Indian economic growth, going forward.

Construction of the Growth Accounts

Although empirical research on productivity growth has used a variety of methodologies, most of the analysis has evolved along two primary paths: growth accounting or direct econometric estimation. Both are based on the underlying concept of an aggregate production function. Growth accounting combines the production function with the assumption of competitive markets, leading to the use of income shares to measure the contribution of factor inputs. This method focuses on identifying contributions of individual factor inputs and a residual, typically called total factor productivity (TFP). In contrast, the econometric approach focuses on exploring alternative functional forms for the production function, and does not rely on any assumption that markets are competitive.

Most empirical studies have tended to emphasize what might be labeled the *proximate causes* of growth: measuring the quantity and quality of capital and labor inputs, and viewing the TFP residual as representing a combination of changes in efficiency and the production technology. More recently, some researchers have sought to go beyond proximate causes, so as to associate the fundamental sources of long-term differences in living standards with underlying differences in institutional and legal arrangements and geography. In these studies, TFP is perceived as the driving force behind growth. Accumulation of both physical capital and labor skills is taken to be largely endogenous—and ultimately induced by changes in TFP. From this perspective, developing a theory of TFP is a central objective.[2]

Basic Growth Accounting Framework

Building from the seminal work by Solow (1957), modern productivity analysis begins with the concept of an aggregate production function. As shown in equation (1), this relates output (Q) to contributions of factor inputs, capital (K) and labor (L), as well as a Hicks-neutral shift in the production function (A):

$$Q_t = A_t F(K_t, L_t) \tag{1}$$

2. Examples of this literature are provided by Klenow and Rodriguez-Clare (1997) and Easterly and Levine (2001).

The next step is to combine the notion of a production function with the assumption of competitive markets in which factors are paid their marginal products. It is then straight-forward to derive a simple index number formulation relating growth in output to increases in factor inputs and a residual shift term, identified with TFP:

$$d \ln Q = s_k d \ln (K) + s_l d \ln(L) + d \ln TFP, \tag{2}$$

where s_k and s_l are the shares of capital and labor income, respectively.[3]

As discussed more fully below, it is often difficult to obtain meaningful time series estimates of factor income shares. Thus, many studies adopt the more restricted Cobb-Douglas production function, which assumes the contribution of each factor to be constant:

$$Q_t = A\left(K_t^{\alpha} L_t^{1-\alpha}\right)^{\gamma}. \tag{3}$$

Again, A represents TFP and γ measures the extent of returns to scale. In this restricted formulation, the s_k and s_l of equation (2) are replaced with constants. Many studies have also simply assumed returns to scale of unity. In the absence of an explicit allowance, returns to scale are subsumed within an overall residual of TFP. That is the approach used in this study.

It has become standard to adjust the factor inputs, particularly labor, to reflect changes in quality. Most of this research follows one of two common approaches. The first seeks to cross-classify the workforce by a number of differentiating characteristics, such as education, age, occupation and gender. Information on these characteristics is combined with data on wage rates, so to compute each subgroup's share of total compensation, v_i. An adjusted measure of the labor input is then computed as

$$d \ln L^{*} = \sum_i v_i d \ln L_i. \tag{4}$$

However, this process is very data intensive. In addition, some analysts object that observed wage differentials may reflect factors other than productivity differences, such as gender or age discrimination.

3. The use of income share weights is critical, because this makes it possible to avoid imposing restrictions on the possible functional forms of the production function. In empirical applications, the factor shares are replaced by average between period shares in a Tornqvist discrete time approximation. Thus s_k is replaced by $(s_{kt} + s_{kt-1})/2$. A summary of this literature is provided in Hulten (2001). OECD (2001) provides a detailed manual, elaborating on the major issues.

The alternative, which we follow here, is to adjust for skill differences using a simple index of educational attainment. For example, an index of the form:

$$L^* = e^{as} L \tag{5}$$

assumes that each year of schooling, s, raises the average worker's productivity by a constant percentage, a. This formulation parallels the vast number of empirical studies that use "Mincer regressions" to measure the relationship between wages and years of schooling. Such studies have been carried out for different time periods and for a large number of countries around the world, typically finding a return to each additional year of education in the range of 7 to 12 percent.[4]

Finally, we would also like to adjust the measure of the capital input for variations in the flow of capital services associated with capital of different service lives. The rapid pace of innovation and economic obsolescence of high-tech capital makes this an issue of growing importance. Unfortunately, few countries have sufficiently detailed information to make these types of compositional adjustments to their capital inputs measure—and India is no exception. The data constraints are particularly acute at the level of individual industries. Instead, an estimate of the capital stock is commonly used as an index of the growth in capital services.[5]

Using this framework, we estimate a set of growth accounts over the period 1960–61 to 2004–05, for the total economy and the three major sectors—agriculture, industry and services—as well as for manufacturing.[6] We have excluded residential housing from services and the total economy because income from housing is based solely on imputations, and is all assigned to capital income. As described more fully below, the output and capital stock data are from the national accounts. These reflect the significant revisions associated with the adoption of the new 1999–2000 base. Estimates of employment are based on results from the quinquennial household surveys.

4. References to many of these international studies are available in Psacharopoulos and Patrinos (2004). We will discuss several specific studies of India in a later section.

5. The essential difference between the two is that the capital stock aggregate is constructed using purchase prices as the relevant weights, while the capital services aggregate would be constructed using rental prices as weights.

6. We follow the grouping traditionally used by the UN and other international organizations. Indian statistical agencies use the same grouping, but refer to them as the primary, secondary and tertiary sectors. The agricultural sector includes forestry and fishing. Industry is comprised of mining, manufacturing, construction and utilities. The services sector covers the remainder of the economy.

Data Sources

The Indian statistical agencies face substantial challenges in preparing measures of output and employment at both the aggregate and sector levels. The difficulties arise primarily because a large portion of the nonagricultural workforce operates outside of standard reporting programs. Furthermore, India's national accounts are highly dependent on a series of quinquennial surveys for information on households and small enterprises. Therefore, annual estimates of output and employment (as well as estimates at higher frequencies), are largely based on simple interpolations and extrapolations of underlying source data. We have relied heavily on the comprehensive analysis of Sivasubramonian (2004) for the development of the requisite data at the level of the total economy. We have extended his analysis by incorporating recent revisions of the national accounts and by developing comparable growth accounts for the major sub-sectors of the Indian economy (agriculture, industry, manufacturing, and services). We have also incorporated an alternative methodology, explained above, to estimate the contribution of improvements in the educational attainment of the workforce.

In the remainder of this section, we discuss the data used to construct growth accounts for India. Output measures are considered first, followed by each of the factor inputs and, finally, measures of factor shares. Along the way, we summarize key data concerns and their implications.

OUTPUT. India has a reasonably good statistical system for measuring output of the agricultural sector and output of non-agricultural enterprises that participate in government reporting programs, and are classified as part of the organized sector.[7] For example, this includes factories registered under the 1948 Factories Act, as well as large portions of mining, utilities, communications and finance. For these enterprises, it is possible to construct estimates of value added for national accounts, using either the production approach or the income approach. Furthermore, original source data are often available annually.

However, most workers are not included within the organized or formal sector of the economy. This point is clearly illustrated in table 1, which provides data for 1999–2000. Its first three columns show the distribution of

7. A recent review of the Indian statistical system is provided in the 2001 Report of the National Statistical Commission, available at: http://mospi.nic.in/nscr/mp.htm. The commission identified some significant areas of deterioration in the quality of the agricultural and industry statistics, and it highlighted the dearth of information about service-producing industries.

TABLE 1. Measures of the Organized and Unorganized Sectors by Industry, 1999–2000

Percent

Industry	*Distribution of GDP by sector*	*Percent of sector GDP*		*Percent of sector employment*
		Organized	*Unorganized*	*Unorganized*
Agriculture, forestry and fishering	25.3	3.1	–	99.1
Agriculture	23.2	3.2	–	99.2
Forestry and logging	1.1	5.6	–	98.3
Fishing	1.1	0.1	–	98.5
Industry	**25.4**	**62.5**	**37.5**	..
Mining and Quarrying	2.3	91.6	8.4	90.7
Manufacturing	14.7	60.8	39.2	97.9
Electricity, gas and water supply	2.5	93.8	6.2	90.1
Construction[1]	5.9	41.8	58.2	85.8
Services	**49.2**	**51.3**	**48.7**	..
Trade	12.9	18.1	81.9	84.7
Hotel and restaurants	1.2	41.2	58.8	90.7
Transport and storage	5.8	35.2	64.8	79.3
Communication	1.6	91.4	8.6	92.8
Banking and insurance	5.9	90.5	9.5	88.7
Real estate, ownership of dwellings and business services	7.1	18.6	81.4	89.9
Public admininistration and defence	6.7	100.0	0.0	0.4
Other services	8.1	69.5	30.5	87.4
Non-agricultural sector	**74.7**	**56.0**	**44.0**	**88.3**
Total[2]	**100.0**	**42.0**	**32.4**	**95.6**

Source: Saha, Kar and Baskaran (2004) and Government of India, Central Statistical Office (2006, February).

Notes: 1. Unorganized employment in construction includes casual laborers in the organized sector.

2. Classification of organized versus unorganized is not applied to agricultural sector and household employment.

GDP by major industry, as well as the share of output in each industry produced in the organized versus the unorganized sectors.[8] The final column shows the percent of employment that is unorganized in each sector.[9] Within the nonagricultural economy, for example, 44 percent of the GDP was in the unorganized sector, while it accounted for 88 percent of total employment.

For the unorganized sector, Indian measures of GDP are constructed using the labor input method. Thus, estimates of labor input at the industry level are combined with measures of value added per worker (VAPW) from a variety of enterprise surveys. Labor input in the unorganized sector is estimated as the residual difference between measures of total labor input and labor input in the organized sector. The latter is obtained from employer reports, while the total labor input measure is constructed from the quinquennial household survey. In this context, it is important to note that labor input is defined in terms of the number of jobs, not the number of workers. Since the objective is to obtain an employment measure equivalent to the one that employers would report (inclusive of multiple job holding), the number of workers reporting a principal employment activity over the prior year is added to the number of workers reporting a subsidiary employment activity. Each worker could be recorded as having up to two jobs. No adjustment is made for full versus part-time work for either primary or secondary jobs.[10]

The techniques described above should generate reasonably good estimates of output in the benchmark years for which survey data are available. However, India has no consistent source of information about employment in the unorganized sector for the years between the quinquennial surveys.

8. The unorganized sector is a bit broader than the related concept of the informal sector. For further discussion of the classification issues in the Indian context see Saha, Kar,and Baskaran (2004) and Kolli and Hazra (2005).

9. Note that the percent of employment in a particular industry that is unorganized may differ from the share of labor input to the unorganized sector. For example, labor inputs in the organized sector may include casual workers, who would be classified as "unorganized employment".

10. The methods used to compute the labor input have varied significantly over time, further restricting the comparability of the estimates of industry value added. The 1950, 1970, and 1980 benchmarks used census estimates, whereas the 1993–94 and 1999–2000 benchmarks used data from the quinquennial employment and unemployment surveys. The 1970 through 1990 census are known to have encountered severe problems in measuring the workforce (Visaria, 2002). Also the 1999–2000 benchmark adjusted for multiple jobs at the level of individual industries, whereas the 1993–94 estimates relied on common ratios from aggregate data. Additional details are available in CSO (2004).

Annual information on value added per worker is equally limited, since the value-added data are also updated on an approximate 5-year cycle. Therefore, detailed calculations of output using the labor input method can only be undertaken for benchmark years. Estimates of value added for the years between benchmarks are obtained by interpolation. Estimates for years since the most recent benchmark are obtained by extrapolating the labor inputs, based on growth between the two most recent benchmarks.

Table 2 provides a stark illustration of the problems created by the lack of underlying annual survey data for the unorganized portions of the economy. The first column shows the sector composition of GDP, using the 1993–94 benchmark revision. The next two columns show two estimates of 1993–94 GDP—one using the 1980–81 benchmark and the other from the revised data. Column 4 shows the percentage difference between the two. The revisions to 1993–94 GDP were substantial, raising the estimate of total GDP by fully 9 percent. In part, the sizable revisions that accompanied the shift to the 1993–94 base reflect the fact that it had been so many years since the introduction of the 1980–81 base. But it is important to point out that the revisions are quite small for those industries that are largely in the organized sector and for which annual sources of information are available. In contrast, the necessity of relying on the labor input methodology and past rates of change to extrapolate output resulted in particularly large output revisions in the service-producing industries (15 percent, on average). Output for the category that includes business services was revised upwards by 103 percent. The lack of good output data for the service industry is a problem in all countries. It is of particular importance for India because of the prominent role that services are expected to play in the country's future growth.

The second panel provides parallel information for the 1999–2000 base revision, comparing the estimate of 1999–2000 GDP using the 1993–94 benchmark, with that from the 1999–2000 benchmark.[11] The percentage revisions, shown in column 8, are much smaller than those associated with the 1993–94 revision—both because fewer years had elapsed and there had been fewer methodological changes. In addition, India adopted many elements of the 1993 Standard National Accounts, which contributed to some of the upward revisions of GDP. The revisions for agriculture and industry were minor, but output of the service-producing industries was increased

11. Prior to the introduction of the 1993–94 base, GDP data were rebased to the decennial census with the last benchmark being 1980. The Central Statistical Office (CSO) has now shifted to a procedure that ties benchmark revisions to the quinquennial household surveys.

TABLE 2. National Accounts Revisions, Benchmark Years, 1993–94 and 1999–2000

Billions of rupees

Sector	*1993–94 GDP by sector*				*1999–2000 GDP by sector*			
	Share of total (1)	*1980–81 series (2)*	*1993–94 series (3)*	*Percent change (4)*	*Share of total (5)*	*1993–94 series (6)*	*1999–2000 series (7)*	*Percent change (8)*
Agriculture, forestry and fishing	**30.3**	**2,237**	**2,424**	**8.4**	**25.3**	**4,620**	**4,541**	**–1.7**
Agriculture	27.9	2,063	2,231	8.2	23.2	4,224	4,153	–1.7
Forestry and logging	1.3	98	102	3.9	1.1	196	195	–0.4
Fishing	1.1	75	91	20.2	1.1	200	192	–3.9
Industry	**25.8**	**2,040**	**2,058**	**0.9**	**25.4**	**4,556**	**4,556**	**0.0**
Mining and quarrying	2.5	168	197	17.1	2.3	413	416	0.7
Manufacturing	15.9	1,276	1,267	–0.7	14.7	2,667	2,641	–1.0
Rregistered	10.4	812	831	2.3	9.7	1,708	1,730	1.3
Unregistered	5.5	464	436	–6.0	5.1	959	911	–5.0
Electricity, gas and water supply	2.4	189	190	0.5	2.5	423	447	5.8
Construction	5.1	407	404	–0.7	5.9	1,053	1,051	–0.1
Services	**43.9**	**3,051**	**3,508**	**15.0**	**49.2**	**8,443**	**8,826**	**4.5**
Trade, hotels and restaurants	13.9	980	1,110	13.2	14.2	2,460	2,541	3.3
Trade	13.2	922	1,056	14.6	12.9	2,290	2,319	1.3
Hotel and restaurants	0.7	59	54	–7.5	1.2	170	223	30.7

Transport, storage and communication	7.3	561	580	3.4	7.4	1,243	1,318	6.0
Railways	1.2	96	96	0.0	1.1	156	195	24.8
Transport by other means	4.8	371	383	3.4	4.6	819	824	0.6
Storage	0.1	6	6	6.9	0.1	13	14	13.1
Communication	1.2	88	94	6.9	1.6	256	284	11.3
Finance, insurance, real estate and business services	11.2	671	896	33.4	13.0	2,206	2,328	5.5
Banking and insurance	5.2	436	417	–4.4	5.9	1,191	1,057	–11.3
Real estate and business services	6.0	236	479	103.3	7.1	1,015	1,271	25.2
Community, social and personal services	11.5	839	923	10.0	14.7	2,534	2,640	4.2
Public administration and defence	5.4	400	431	7.9	6.7	1,167	1,197	2.6
Other services	6.2	439	492	12.0	8.1	1,367	1,443	5.6
Total GDP at factor cost	**100.0**	**7,329**	**7,991**	**9.0**	**100.0**	**17,618**	**17,923**	**1.7**

Source: Central Statistical Organisation (2004, p.8), Central Statistical Organisation (2006, February, p.11), and authors' estimates.

by 4.5 percent, adding almost a percentage point to the annual growth rate. And once again, the revisions were quite large in some sub-sectors, such as the category that includes business services.

The problems with annual output estimates in non-benchmark years suggest that debates over the precise timing of changes in India's rate of GDP growth around episodes of economic reform should not be taken very seriously. Annual changes, based on extrapolations from the last benchmark, may be misleading. In contrast, the benchmark estimates themselves are constructed with considerable detail and a strong anchor in the quinquennial surveys. This provides a reasonable degree of confidence for focusing on those selected years to study India's economic performance.

In the past, the CSO has provided revised historical estimates of GDP and its components that are consistent with the latest benchmark. However, similar data have not yet been published following the introduction of the new 1999–2000 base. In the absence of published data, we have assumed that the 1999–2000 percentage revision reflected a drift in the annual estimates, and we distributed this discrepancy back to 1993–94 in a linear fashion. We continue to measure output in 1993–94 prices. The output data of 1993–94 and earlier years are assumed to be unchanged.[12]

CAPITAL STOCK ESTIMATES. Estimates of the capital stock by industry are available back to 1950. However, these are dependent on the underlying measures of investment by industry, and there is little direct information on capital service lives. The CSO compiles two separate estimates of capital investment. First, aggregate investment by asset type is based largely on a commodity-flow method. Second, investment by industry is compiled from establishment surveys, which do not have asset detail. The two estimates have differed substantially in some years. We have used the industry-based estimates because we need estimates of the capital stock by broad industry groups.

The annual estimates of investment are subject to uncertainties between benchmark years that are similar to those discussed above for output data. Again, the problems are most evident in the published revisions at the time a new base year is adopted. The 1993–94 benchmark revisions increased total investment of all industries by a relatively modest 9 percent.[13] Somewhat surprisingly, the changes associated with the shift to the 1999–2000

12. This procedure closely follows the description by the CSO for its revisions of the historical data after the 1993–94 revisions.

13. At the sector level, the percentage adjustments were; 6 percent for agriculture, 18 percent for industry, and 4 percent for services (Central Statistical Office, 1999, pp. 39–40).

base are much more substantial—despite the passage of just 5 years since the prior benchmark. Total industry fixed investment in 1999–2000 has been increased by 33 percent, with revisions for agriculture, industry and services to 57, 17, and 46 percent respectively.[14]

The recent investment revisions are sufficiently large to have a major effect on estimates of capital stock growth since 1993–94. Since official capital stock revisions are not yet available, we have created new estimates for the major economic sectors, and for manufacturing, for the period of 1993–94 to 2004–05. As with output, we have phased in the investment revisions beginning in 1993–94. For the capital stocks, we created approximate measures using a fixed geometric rate of depreciation. These approximate measures were then recomputed for the period after 1993–94, using both the old and the revised estimates of investment. The percent adjustment for each year was applied to the corresponding official series to obtain our final revised capital stock series. For 2004–05, the last year of published data, our methodology implies that the revisions increased the overall capital stock by 15 percent, with even larger increases for agriculture and services.

LAND INPUT ESTIMATES. Our growth accounts include land as well as capital and labor as factor inputs to produce agriculture. An estimate of the volume of land used in agricultural production is available annually (Directorate of Economics and Statistics, 2005). However, there are no available estimates of current market value of the land that would enable us to construct measures of the annual flow of capital services. We use an estimate of total cropped land that adjusts for irrigated lands, sown more than once per year.

EMPLOYMENT. Difficulties also arise in the effort to construct reliable annual estimates of employment, and thus labor productivity. The censuses of 1971, 1981, and 1991 are believed to have produced solid estimates of the overall population, but to have grossly underestimated the worker-population ratio (WPR) and thus the size of the total workforce. Visaria (2002) discusses these problems and suggests the need for corrections on the order of 26 (1971), 15 (1981), and 12 (1991) percent to the reported figures.[15] In contrast, the quinquennial surveys appear to yield consistent

14. CSO (2006), table 30, p. 53. The revisions to the commodity-flow estimates were much smaller, but the methodology was changed to bring the industry estimates into line with those based on the commodity flow method.

15. Provisional estimates of the WPRs are available for the 2001 census. The values appear to be much closer to the 1999–2000 quinquennial survey than in past censuses.

estimates of WPRs, but to underestimate the total population. Thus, estimates of India's labor force are typically generated by combining the survey-based estimates of the WPR for four component groups (rural men, rural women, urban men and urban women) with estimates of the corresponding populations, obtained by interpolating the census data. As a result, reliable estimates of the total workforce are limited to the years covered by the seven quinquennial household surveys that were conducted over the period 1972–73 to 2004–05. Annual estimates for the aggregate economy can only be obtained by interpolation of the results from those surveys.[16]

The NSSO surveys incorporate several distinct measures of the economic activities of the population. These are based on the prior year (usual status), the prior week (current weekly status) and each day of the reference week (daily status). They also distinguish between the principle activity status (plurality of time) and subsidiary status. Most researchers have relied on a count of persons with employment in usual status (either principle or subsidiary). However, unlike the national accounts their estimates are based on a count of persons, not a count of jobs. Visaria (2002) used estimates of worker participation rates from the quinquennial surveys and interpolated estimates of the populations of rural and urban males and females to produce estimates of the workforce. Sivasubramonian (2004) interpolated those estimates to obtain annual data for the aggregate economy.

We have updated the data of Visaria and Sivasubramonian using slightly different estimates of the WPRs by gender and sector from the NSSO surveys, and extended the estimates through 2004. We have also used information from the surveys to allocate employment among the sectors: agriculture, industry (and manufacturing), and services. The calculations are shown in appendix table A-1. The resulting estimates of employment apply to the seven years covered by surveys from 1973 to 2004. We combined those observations with estimates from the 1961 Census, and interpolated the data to obtain annual measures of employment by sector for the period from 1960–61 to 2004–05.

These employment surveys also provide information about the highest level of educational attainment for individuals in the workforce. These measures can be used to adjust the workforce for improvements in quality over time. Thus, for constructing the growth accounts, we computed average years of schooling for workers over age 15 in the three sectors of agriculture,

16. A recent evaluation of the potential usefulness of the smaller annual NSO surveys, which were undertaken in other years, is provided by Sundaram and Tendulkar (2005a). They concluded that the WPRs are not sufficiently comparable with those of the quinquennial surveys. Bhalla and Das (2006) reach a contrary conclusion.

industry, and services. We assumed a 7 percent return for each year of schooling in constructing an index of labor quality as in equation (5).[17] Estimates of earnings are also available for four micro data sets that cover the 38th, 50th, 55th, and 60th rounds that enable us to compute estimates of the returns to education over the 1983–2004 period. The analysis of the gains in educational attainment and their relationship to earnings are discussed more fully in a later section.

FACTOR INCOMES. The distribution of income payments between capital and labor is an important input into growth accounts because as discussed above, under conditions of competitive markets, income shares can be used to measure the contributions of each factor. However, such estimates are problematic for India (and most developing countries) because the self-employed play such a dominant role in total employment. Their earnings, which are labeled as mixed income in the national accounts, reflect a combination of income from capital and their own labor. In industrial countries, where the income of the self-employed is a small proportion of the total, it is common to impute a wage equal to that of their employees or a return on capital equal to that of the corporate sector. In India, however, mixed income accounted for fully 45 percent of NDP in 2002–03, and 79 percent of the income of the unorganized sector, which is a slowly declining share of the total economy (CSO, 2005, p. xlv). The importance of mixed income raises strong doubts about the validity of the imputation technique for such a large income component.[18]

We have used fixed factor shares in our analysis. That implies a more restrictive range of production functions, but the analysis of industrial countries—where information on factor income shares are available—suggests little variation in share weights over time. We have also assumed constant returns to scale in all three sectors—any such gains are allocated to the TFP residual. For agriculture, our assumed shares are 0.5, 0.25, and 0.25 for labor, capital, and land respectively.[19] For industry and services, we used a simple capital share of 0.4. For the aggregate economy, we

17. As discussed later, returns to schooling in India seem comparable to international experience, and the assumption of a 7 percent return is consistent with our estimates for other countries (Bosworth and Collins, 2003).

18. Sivasubramonian (2004) allocated mixed income between labor and capital on the basis of the distribution of income in the private organized sector. The result is a labor share that declines from 55–60 percent of GDP in the 1960s to 45–50 percent by the late 1990s.

19. See Evenson and others (1999, p. 40). The values are an average of their results for 1967, 1977, and 1987. They included a weight for fertilizer; but because our data are based on valued added, we scaled up the estimates for the other inputs. A similar procedure was used to compute agricultural TFP in Bhattarai and Narayanmoorthy (2003).

combined the factor shares of individual sectors, weighted by their share of total nominal nonresidential GDP. The share of agriculture, for example, declines from 52 percent of the total in 1960–61 to 23 percent in 2004–05. We also conducted some sensitivity analysis using different values for the factor shares. However, in the case of India, choice of specific shares has little impact on the analysis because, in general, there have been relatively small differences in the growth rates for the labor and capital inputs. Thus, the total contribution of the factor imputs and the estimats of TFP are only marginally affected.

India's Growth Accounts: Results and Discussion

In this section, we present our updated growth accounts—first for the total economy and then by major sector. The results reflect many of the now standard themes in the literature on India's economic development. However, some new findings emerge as well. Thus, drawing implications from our results, we build on the existing literature to discuss some of the key issues for India's growth experience and prospects for the future. The basic growth accounts are provided for the aggregate economy in table 3 and by sector in table 5, and we refer to these data throughout the discussion.

Aggregate Growth

We begin by looking at growth performance over the relatively long periods 1960–80 versus 1980–2004 (lines 1–3 of table 3). This split reflects the widespread view that the performance of the Indian economy changed

TABLE 3. Sources of Economic Growth, Total Economy, 1960–2005
Annual percentage rate of change

				Contribution of			
Period	*Output*	*Employment*	*Output per worker*	*Physical capital*	*Land*	*Education*	*Factor productivity*
1960–2004	4.7	2.1	2.6	1.2	–0.1	0.3	1.2
1960–80	3.4	2.2	1.3	1.0	–0.2	0.2	0.2
1980–2004	5.8	2.0	3.7	1.4	0.0	0.4	2.0
1960–73	3.3	2.0	1.3	1.1	–0.2	0.1	0.2
1973–83	4.2	2.4	1.8	0.9	–0.2	0.3	0.6
1983–87	4.0	1.6	2.4	1.2	0.0	0.3	0.9
1987–93	5.7	2.4	3.2	0.7	–0.1	0.4	2.2
1993–99	7.0	1.2	5.8	2.4	–0.1	0.4	2.8
1999–2004	6.0	2.8	3.2	1.1	0.1	0.4	1.7

Source: Authors' calculations as explained in text.

TABLE 4. Sources of Growth, Regions, 1960–2003

Region/Period	Output	Output per worker	Contribution of: Physical capital[a]	Contribution of: Education	Contribution of: Factor productivity
India					
1960–80	3.4	1.3	0.8	0.2	0.2
1980–04	5.8	3.7	1.4	0.4	2.0
China (1)					
1960–80	4.0	1.8	0.8	0.4	0.6
1980–03	9.5	7.8	2.8	0.4	4.5
South Asia (4)					
1960–80	3.6	1.4	1.0	0.3	0.3
1980–03	5.5	3.4	1.2	0.4	1.7
East Asia less China (7)					
1960–80	7.0	4.0	2.2	0.5	1.2
1980–03	6.1	3.7	2.2	0.5	0.9
Latin America (23)					
1960–80	5.7	2.7	1.0	0.3	1.4
1980–03	2.0	–0.6	0.1	0.4	–1.1
Africa (19)					
1960–80	4.4	1.9	1.0	0.1	0.8
1980–03	2.2	–0.6	–0.1	0.4	–0.9
Middle East (9)					
1960–80	5.4	3.2	1.8	0.4	1.0
1980–03	3.8	0.8	0.3	0.5	0.0
Industrial Countries (22)					
1960–80	4.2	2.9	1.2	0.4	1.3
1980–03	2.6	1.6	0.8	0.2	0.6

Source: Authors' calculations as explained in text and Bosworth and Collins (2003).
Note: a. For India, combines contribution of physical capital and land.

significantly after 1980. However, as discussed above, there is an on-going debate about the precise timing of the growth acceleration, the role of economic reforms and the relative importance of changes undertaken during the 1980s versus those undertaken after the 1991 economic crisis.

The more rapid GDP growth after 1980 is clearly evident, from an average of 3.4 percent per year during the period from 1960–80 to 5.8 percent during 1980–81 to 2004–05. It is noteworthy that nearly all of the output growth during the first period is associated with increases in factor inputs. However, the post-1980 acceleration is concentrated in improvements in the efficiency of factor use, TFP.[20] That the gains should be concentrated in

20. Previous studies have also concluded that growth in factor inputs accounted for most of the growth in output during the "pre-reform" period. For example, see Dholokia (2002), who defines this earlier period as 1960–85.

TFP seems reasonable in light of the fact that the growth gains are typically attributed to shifts in the policy regime beginning around 1980 that initiated an ongoing process of liberalization and opening up of the economy. The associated increases in reliance on markets and reductions in the role of government would be expected to result in improved economic efficiency.

However, there has been little or no net gain in the rate of job growth, and only a modest pickup in the rate of growth of both physical and human (education) capital per worker. At the level of the total economy, the lack of acceleration in employment is not a surprise since it is driven by population growth; but as other authors have noted, the lack of strong gains in capital is in striking contrast to the experience of East Asian economies. Their periods of rapid growth have been characterized by significant capital deepening and rapid increases in educational attainment.[21] We discuss India's experience with both human and physical capital accumulation in greater detail in a following section.

We can also examine shorter periods by focusing on the intervals between the quinquennial surveys. We argued above that data for these years are likely to be more reliable because the survey results are a primary input to the national accounts and provide the only direct measure of employment. As shown in table 3, growth in output per worker strengthened from just 1.8 percent per annum in 1973–83 to 2.4 percent in 1983–87, and 3.2 percent in 1987–93 before surging to 5.8 percent in 1993–99. These figures suggest a sustained improvement in the underlying trend. However, they do not enable us to pin down the precise timing of the growth acceleration. The decomposition shows that the contribution from TFP growth jumped after 1987 and has remained relatively high. Growth did slow over the 1999–04 period, but this appears largely due to a severe agricultural drought in 2003–04. Moreover, preliminary data for 2005–06 suggest a strong 8.4 percent annual growth rate, and a three-year average above 8 percent.

As discussed above, our measures of physical capital accumulation reflect significant upward revisions to investment in the 1999–2000 benchmark. We have phased these into our capital stock estimates beginning in 1993–94. The resulting contribution of increased capital per worker during 1993–99 of 2.4 percent per annum is similar to levels observed during East Asia's rapid growth periods. However, India's capital deepening slowed after 1999.

21. See Young (1995) and Bosworth and Collins (2003).

International Comparisons

Table 4 compares India's growth performance with that in China and other regions. As shown, in the 1960–80 period India was outperformed in terms of growth in total output as well as output per worker by all of the world's regions, as well as by China.

Although the contribution from increases in capital per worker in India were comparable to the averages for Latin America and Africa, the gains from TFP were considerably lower. In contrast, India's growth since 1980 exceeds that for all regions except East Asia, averaging more than 2 percent per year above the industrial country growth rate. While capital deepening, and especially TFP growth, accelerated in India, both collapsed in Latin America, Africa and the Middle East. Although the contribution of capital accumulation remained well below that for China and East Asia; India achieved impressive rates of TFP growth at the aggregate level. In the next sections, we decompose India's performance by sector to examine the features of the acceleration in greater detail.

Agriculture

The growth accounts for India's major sectors are shown in table 5. The first panel summarizes the growth performance of the agricultural sector. The contrast between the increase in output per worker in 1960–80 (growth of just 0.1 percent per annum) and 1980–2004 (1.7 percent per annum) highlights the role of the green revolution. The new technology began to be introduced in the late 1960s and early 1970s. Our decomposition shows TFP growth jumping from –0.2 percent per year during 1960–73 to 0.9 percent per year during 1973–83, and to an average of 1.2 percent during 1983–99 (though as shown, it was quite variable during sub-periods). This estimated acceleration in TFP growth is consistent with a number of recent studies focused on agriculture.[22] It also is coincident with other changes that expanded the role of private decision-makers. There has been some concern that the rate of improvement in agriculture has begun to moderate, possibly suggesting lower returns to the government's R&D and extension service expenditures on the sector. However, our results do not suggest a clear pattern—except for the most recent five year period which includes the drought. There is still considerable margin, judged by the performance in comparator countries, for improvements in agricultural yields.

22. See, for example, Coelli and Rao (2003), Everson and others (1999), Foster and Rosenzweig (2004), and Janaiah et al. (2005).

TABLE 5. Sources of Economic Growth, Major Sectors, 1960–2005
Annual percentage rate of change

				Contribution of			
Period	*Output*	*Employment*	*Output per worker*	*Physical capital*	*Land*	*Education*	*Factor productivity*
Agriculture							
1960–2004	2.4	1.4	0.9	0.3	–0.1	0.2	0.6
1960–80	1.9	1.8	0.1	0.2	–0.2	0.1	–0.1
1980–2004	2.8	1.1	1.7	0.4	–0.1	0.3	1.1
1960–73	1.8	1.9	–0.2	0.2	–0.2	0.1	–0.2
1973–83	2.9	1.6	1.3	0.3	–0.1	0.2	0.9
1983–87	0.1	0.5	–0.5	0.3	0.0	0.2	–1.0
1987–93	4.8	2.0	2.8	0.1	–0.2	0.2	2.7
1993–99	2.6	0.2	2.4	0.7	0.1	0.3	1.3
1999–2004	1.8	1.4	0.4	0.8	–0.3	0.4	–0.4
Industry (Inclusive of Manufacturing)							
1960–2004	5.6	3.3	2.4	1.7		0.3	0.4
1960–80	4.7	3.1	1.6	1.8		0.3	–0.4
1980–2004	6.4	3.4	3.0	1.6		0.3	1.1
1960–73	4.7	2.3	2.4	2.3		0.2	–0.1
1973–83	5.2	4.5	0.7	1.2		0.4	–0.8
1983–87	6.0	4.6	1.4	1.0		0.3	0.2
1987–93	5.9	1.7	4.2	1.6		0.4	2.2
1993–99	6.9	2.4	4.5	3.0		0.4	1.1
1999–2004	6.4	5.0	1.4	0.1		0.2	1.2
Manufacturing							
1960–2004	5.7	2.7	3.1	1.8		0.3	0.9
1960–80	4.6	2.7	2.0	1.5		0.3	0.2
1980–2004	6.6	2.7	4.0	2.1		0.4	1.5
1960–73	4.9	1.6	3.4	2.1		0.2	1.0
1973–83	5.3	4.2	1.1	1.0		0.4	–0.3
1983–87	6.2	2.4	3.7	1.4		0.3	2.0
1987–93	5.8	1.8	4.0	1.3		0.4	2.2
1993–99	7.2	1.6	5.5	4.6		0.5	0.4
1999–2004	6.4	4.8	1.7	0.2		0.3	1.1
Services							
1960–2004	6.3	3.3	3.0	0.9		0.4	1.7
1960–80	4.9	2.8	2.0	1.1		0.5	0.4
1980–2004	7.6	3.8	3.8	0.7		0.4	2.7
1960–73	4.7	1.7	3.0	1.9		0.4	0.6
1973–83	5.3	4.5	0.8	–0.1		0.6	0.3
1983–87	6.9	3.3	3.5	0.5		0.3	2.7
1987–93	6.3	4.1	2.2	0.1		0.5	1.5
1993–99	10.2	3.1	7.0	1.5		0.4	5.0
1999–2004	7.8	4.4	3.4	0.5		0.4	2.5

Source: Authors' estimates as described in text.

One surprise is that agricultural employment continues to grow. The experience with similar stages of development in other countries has been that employment within agriculture tends to decline as underemployed workers are drawn out of agriculture into industry and services. In this context, India's experience is particularly notable because, as is well known, a relatively large share of India's employment remains in agriculture. However, the share of agriculture in value added is similar to that for other countries at similar income levels.[23]

Industry

The second panel of table 5 shows that industrial output growth also quickened after 1980. However, the magnitude of this increase was less than for the economy as a whole. Employment growth rose by about 0.3 percentage points, to 3.4 percent per annum, while the contribution of capital per worker remained low, and the gains in educational attainment of the workforce have been modest. Although all of the improvement in labor productivity can be traced to higher growth in TFP, this also remains low by international standards. Further, the figures in table 5 show TFP growth as most rapid during 1987–93, and then slowing, not accelerating, during the post reform period. The trend is disappointing in light of the attention that has been devoted to the on-going liberalization of the trade and regulatory regimes for goods production. These results parallel those of some other researchers, who also found somewhat disappointing performance of the industrial sector in recent decades.[24]

But a low rate of TFP growth in industry is not necessarily a surprise. First, it was a common feature of the early stages of growth in other Asian countries (Young, 1995). Certainly, the industrial base is likely to be inefficient initially, providing some room for productivity gains. But to the extent that developing country growth is a process of adopting the existing production technologies of more industrialized economies, longer-term gains in industrial sector TFP are likely to be minimal. In particular, suppose that the requisite capital and technology are purchased in global markets, and then combined with an advantage in low-cost labor to produce an output that is also sold in competitive global markets. This is not a process that is likely to generate large productivity residuals—or large economic rents. Any TFP gains would be more likely to be found in the production of goods for the domestic market, as inefficient producers decline in importance.

23. For example, see Virmani (2005) for a recent discussion of this point.
24. Recent discussions include Wallack (2003) and Kohli (2006b).

At the aggregate level under this scenario, gains in TFP will largely emerge from the shift of resources among the sectors.[25]

In any case, there remains considerable scope for growth of India's industrial sector, especially compared with industrial growth in Korea during the 1970s and China during the 1990s. In particular, India's employment share in industry remains surprisingly low given its development level. Raising living standards will require expansion of relatively labor-intensive activities, so as to productively employ the large pool of low-skilled workers who are currently under-employed in agriculture.[26] At its current stage of development, India's priority is to generate employment in industry. Less concern need be devoted to increases in sectoral TFP.

Because much of the discussion of India's economic growth has focused on manufacturing, we extracted it from the rest of the industrial sector and compiled a separate set of accounts. Our data include both the registered and unregistered portions of manufacturing.[27] Together they account for roughly half of the industrial sector, but only about 15 percent of overall GDP. As shown in the third panel of table 5 the general pattern of growth for manufacturing is similar to that for the total industry. However, while both show growth accelerations during the 1980s, the surge in manufacturing began earlier, during 1983–87. The investment boom of the mid-1990s and the subsequent collapse are also evident in the large change in the capital contribution before and after 1999–2000.

Manufacturing experienced a slowing of TFP growth after 1993 that was more severe than that reported for industry as a whole, but the improvement in the last 5 years is more pronounced. The early and mid-1990s were marked by major reductions in industrial tariffs that intensified the competitive pressures on domestic manufacturing and mining. Thus, we would expect some initial reduction in TFP, but a steady pickup of growth as the old capital depreciates and new technologies are adopted by an increasing proportion of the industry. The cycle appears to have been amplified by a significant buildup of excess capacity in the mid 1990s, leading to a sharp

25. To the extent that India used trade restrictions to limit the importation of low-cost capital machinery in favor of domestic producers, we would expect the performance to be even worse.

26. Many authors have made this point, including Banga (2005), Virmani (2005), and Krueger (2005). In this context, Foster and Rosenzweig (2004) highlight the role of increased non-agricultural activity in rural areas for raising rural incomes.

27. The registered portion has increased from 58 percent of the total in 1980 to about 65 percent today.

downturn in both output and capital accumulation at the end of the decade. That excess capacity has been largely eliminated in recent years.

It is notable that employment growth in manufacturing has been consistently slower than for industry overall, giving rise to somewhat faster rates of growth of both labor productivity and TFP. Paradoxically, this has also implied that the manufacturing sector has become more capital intensive. (see Kochhar et. al. 2006) However, the measure of TFP in manufacturing is sensitive to the precise factor share that is used to combine the inputs. This is the one case in which the growth rates of capital and labor differ by a significant amount in some periods.

The general pattern of our results for the post-1993 period is comparable to the results reported in Goldar (2004). However his study used data from the Annual Survey of Industries (ASI), and it related only to the registered portion of manufacturing. Goldar also found that TFP growth slowed somewhat after 1991, but the analysis could only cover the years up to 2001–02, the last year for which ASI data are available.

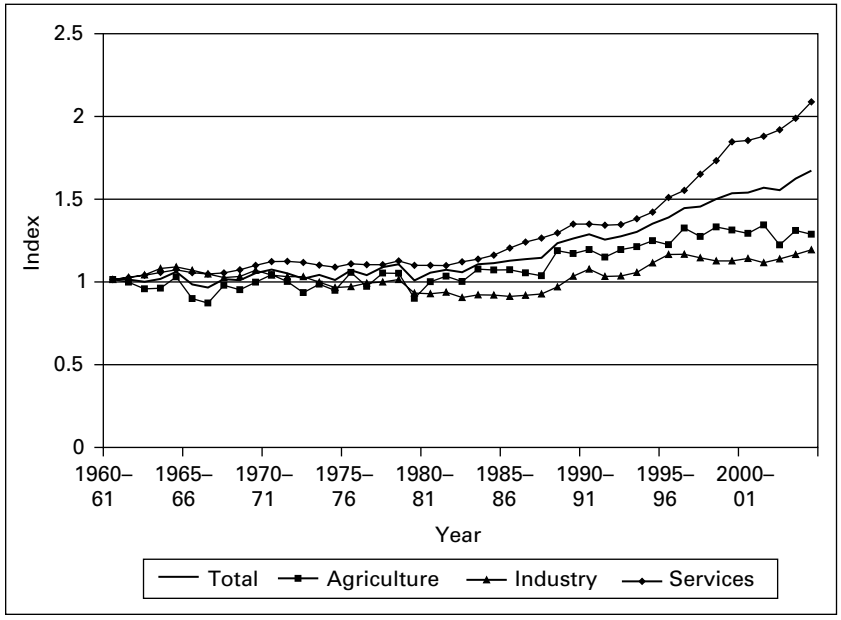
Services

The bottom panel of table 5 summarizes the growth performance of the service sector. As frequently noted, service-producing industries have been the primary source of India's growth surge, consistently outperforming industry/manufacturing.[28] Indeed, since 1980, output growth has exceeded the pre-1980 growth rate by 2.7 percent per year—and maintained an average annual growth of 7.6 percent. Furthermore, employment growth in the sector has averaged 3.8 percent per year, roughly comparable to that for industry. However, increases in capital per worker have made an even smaller contribution to growth of the services sector than for industry. The result is that gains in output per worker are dominated by high rates of improvement in TFP, averaging 2.7 percent annually. We also note that this sector has registered the largest improvements in the educational attainment of its workforce. Turning to the results for the shorter sub-periods, both output per worker and TFP growth accelerated during 1983–87, slowed somewhat and then took off after 1993.

28. Banga (2005) provides a recent overview of the issues associated with India's rapid growth in services. She highlights explanations for and implications of the so-called "job-less growth" in India's service sector whereby increases in the share of GDP have not been associated with equivalent increases in the share of employment. Banga and Goldar (2004) argue that services are increasingly important as an input to Indian manufacturing. See also Gordon and Gupta (2004). Srinivasan (2005) focuses specifically on the development of India's IT sector and its implications for growth.

Another perspective on the role of TFP in India's post-1980 growth is provided by figure 1, which displays annual TFP trends by sector and for the total economy. The dominance of the service-producing industries and the relatively weak performance of the goods producers are both very evident. The chart also shows that the growth of TFP in services has been remarkably consistent over the past quarter century and shows few signs of abating.

FIGURE 1. Growth in TFP by Major Sector, 1960–2004
Index, 1960 = 1.0



The source of such strong TFP growth in services, however, is puzzling. Information on employment is not available at a sufficient level of detail to compute productivity indexes; but greater detail is available for the output measures. Thus, table 6 reports growth in the component industries and their contribution to the growth of the total (defined to exclude housing). We have separated the sector into a modern component that includes communications, finance, business services, education and medical care, and a traditional sector of trade, transportation, public and personal services. Communication, finance and especially business services have received considerable attention as areas in which India has done well. The middle panel shows that these sub-sectors do indeed stand out, with high average rates of growth. Yet, business services account for just 5 percent of the overall

TABLE 6. Growth in Component Service-Producing Industries, 1980–2004

Percentage

	Modern services					*Traditonal services*				
Period	*Total*	*Communications*	*Finance*	*Business services*	*Education & medical*	*Total*	*Trade*	*Transportation*	*Other services*	*Services less dwellings*
					Share of Total Output in Services					
1960–61	19	2	6	1	10	81	40	14	27	100
1980–81	22	3	7	1	11	78	37	16	24	100
1993–94	31	3	14	2	12	69	34	14	21	100
1999–2000	35	6	14	4	12	65	33	12	19	100
2004–05	40	11	12	5	11	60	33	11	16	100
					Annual Percentage Rate of Change					
1960–80	5.7	6.9	5.9	3.4	5.5	4.6	4.5	5.6	4.3	4.9
1980–93	9.0	7.1	12.3	9.8	6.6	5.4	5.6	5.4	4.9	6.3
1993–99	12.6	20.3	9.3	28.0	10.6	8.9	9.8	7.5	8.6	10.1
1999–2004	10.5	23.8	5.7	11.4	7.1	6.5	7.9	5.7	4.3	8.0
					Percentage Contribution to Total Services Growth					
1960–80	1.1	0.1	0.3	0.0	0.5	3.8	1.8	0.8	1.2	4.9
1980–93	2.0	0.2	0.9	0.1	0.7	4.2	2.1	0.9	1.2	6.3
1993–99	3.9	0.7	1.3	0.5	1.2	6.2	3.3	1.1	1.8	10.1
1999–2004	3.7	1.3	0.8	0.5	0.8	4.2	2.6	0.7	0.8	8.0

Source: authors' calculations from CSO (2006) and prior years.

sector's output, and the entire modern component accounted for less than half of the growth between 1980–81 and 2004–05.

Instead, the acceleration of the sector's growth has been very broadly based, including trade, transportation, and community and personal services. But these are not industries in which we would anticipate rapid productivity growth. As stressed by Baumol (1967) services are normally an area of limited productivity growth. That characterization is changing with respect to portions of what we have called modern services because IT capital greatly altered the production process. On the other hand, although services are a major IT user in the United States, the adoption of the capital has not been accompanied by supernormal returns that might spillover into TFP.[29] Education and government services are other large sectors in which we would not expect to observe significant productivity growth.

An alternative explanation is that increases in the price of services are being underestimated, leading to an overstatement of real growth. However, this hypothesis is difficult to verify. We can only note that, while inflation has averaged 7.5 percent overall since 1980, inflation has also been remarkably similar for agriculture, industry and services. During 1980–2005, the services price deflator rose at an average annual rate of 7.5 percent, compared with 7.4 percent in both agriculture and industry. It seems extremely unlikely that all three price deflators would grow at nearly identical rates over such a long period.

From an international perspective, the finding of large TFP gains in the service industries is atypical. Most countries, lacking measures of physical output, extrapolate the output of services with indexes of the inputs.[30] Thus by construction, they eliminate the possibility of reported productivity gains. This does not appear to be a common practice in the Indian national accounts. While up-to-date information on the methods used to adjust for price inflation is limited, it appears that the output of some service industries is adjusted only for general (CPI) inflation (CSO, 1989). In the case of trade, margins are assumed to be constant in real value and change in line with total sales. Furthermore, because so much of services lies outside the organized sector, the Indian statistical agencies have little

29. Triplett and Bosworth (2005).

30. The most common methods are to use an index of employment to represent real growth, or equivalently to deflate the nominal values by change in average wage rates. In recent years, the U.S. and some other OECD countries have moved away from this input-based valuation by developing explicit price indexes for services. However, the method is still used for government and education.

or no direct information on the output of services. To a large extent, they are forced to rely on extrapolation of the base year values.

In summary, the growth of the service sector has been sustained and very broadly based. However, the extent that it is concentrated in TFP and not employment does give us pause. In addition, the lack of employment data at a more detailed level prevents us from exploring the source of the TFP gains in greater detail.

Reallocation Effects

A potentially important source of growth comes from the reallocation of resources from less productive to more productive activities. Traditionally, this has been associated with a shift of labor from agriculture, where there is initially substantial under-employment, to industry and then services. Our data indicate that Indian value added per worker in industry and services is 4 to 5 times that in agriculture (table 7). Thus, employment shifts from agriculture to either of these sectors should contribute to substantial gains in productivity and average incomes. We have already seen (table 5) that employment has grown more rapidly in industry and services than in agriculture, and that these sectors have experienced greater capital deepening. Both of these trends have implied some sectoral reallocation of factors. However, as discussed above, there remains considerable scope for additional labor reallocation out of agriculture.

TABLE 7. Growth in Output per Worker, 1960–2005, Sectoral Growth vs. Reallocation Effects
Annual percentage rate of change

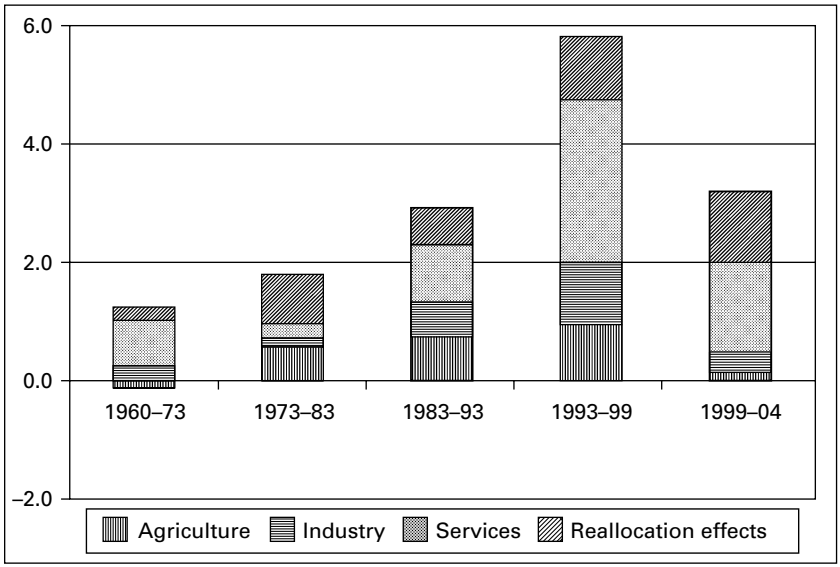
Period	*Total economy (1)*	*Weighted sectoral growth (2)*	*Reallocation effects (1)–(2)*	*Contribution of*		
				Agricultural	*Industry*	*Services*
1960–80	1.3	0.9	0.4	0.04	0.3	0.5
1980–2004	3.7	2.8	1.0	0.7	0.8	1.3
1960–73	1.3	1.1	0.2	–0.1	0.4	0.8
1973–83	1.8	1.0	0.8	0.6	0.2	0.2
1983–93	2.9	2.3	0.6	0.6	0.8	0.9
1993–99	5.8	4.8	1.0	0.8	1.3	2.7
1999–2004	3.2	2.0	1.2	0.1	0.4	1.5
Memo: GDP/ Worker (2004, in Rupees)	32,596			11,964	51,364	66,323

Source: Tables 3 and 5 and authors' estimates as described in the text.

Table 7 and figure 2 provide an estimate of the contribution of factor reallocation to India's growth. For each period, we show the contribution to the total of growth in each of the three sectors, weighted by the sector shares. The data for total and sector growth are taken directly from tables 3 and 5. The contribution of resource reallocation is the difference between the economy-side increase in labor productivity and the sum of the individual sector contributions. Post-1980, our calculations show that this reallocation contributed roughly one percent per year to output growth. Our findings also suggest that this component has become increasingly important in recent years.[31]

FIGURE 2. Growth in Output per Worker, 1960–2005, Sectoral Growth vs. Reallocation Effects

Annual percentage rate of change



The Role of Capital Accumulation: Additional Perspectives

In recent years, controversy has surrounded the roles of physical capital and education (human capital) in the growth process. Young (1995) has shown the dominance of physical capital accumulation in the growth of the

31. See Bosworth (2005) for a similar calculation applied to Thailand. Using a different methodology, Wallock (2003) also concludes that much of India's post 1980s growth is attributable to resource movements.

East Asian economies. On the other hand, Klenow and Rodriguez-Clare (1997) argue that physical capital accumulation is largely induced by increases in TFP, a phenomenon that leads to an overstatement of the contribution of physical capital as an exogenous source of growth, and an understatement of the role of TFP.[32] Hulten and Srinivasan (1999) apply this argument to Indian manufacturing growth during 1973–92. Easterly and Levine (2001) argue that only a small percentage of the variation in growth across countries can be attributed to capital accumulation. Baier and others (2006) argue the opposite. Our own reading is that both capital accumulation and gains in TFP are important components of the growth process (Bosworth and Collins, 2003), although we agree that the precise magnitude of the role varies across countries. Capital accumulation is a necessary part of the process—regardless of whether it is an exogenous or induced factor. Furthermore, the investment underlying that capital accumulation must be financed through national or foreign saving.

The role of education has been equally controversial. Many studies, including our own, have relied on the strong microeconomic association between education and earning to adjust the workforce for improvements in educational attainment.[33] Again, rapid gains in educational attainment have been a particular feature of many of the fast-growing East Asian economies. Easterly (2001) and Pritchett (2001) question the relationship between education and growth at the aggregate level.

The growth accounts presented above imply that both human and physical capital have made relatively modest contributions to India's growth performance by international standards. We examine each of these areas in more detail below. Our examination of human capital first reviews the evolution of educational attainment. Using individual level data for selected years from 1983 to 2004, we then present new estimates of the extent to which Indian labor markets reward workers for various levels of additional schooling. This issue is of particular relevance, because increases in educational attainment have evolved somewhat differently in India than for other rapidly growing Asian economies—beginning with the push at tertiary levels, educating large numbers of engineers and scientists, and only since 1986 emphasizing primary education more broadly. Finally, the section turns to a discussion of investment and saving in India. While India's

32. Much of this debate revolves around the choice of the Harrodian, instead of the Hicksian approach to measuring TFP. The Harrodian formulation effectively assigns a larger role to TFP by assuming that a portion of the capital accumulation is endogenous and induced by an increase in TFP (Hulten, 1975).

33. See Bosworth and Collins (2003) for a discussion of the differing perspectives.

national saving rate has been rising and compares favorably to that for low income countries, it remains below that for high growth Asian economies. Is saving likely to act as a constraint for India's growth? We use the accounting identity linking investment to saving to frame our discussion, and explore the evolution over time as well as across sectors. Once again, a variety of issues arise, regarding the data available for measurement of both saving and investment.

The Contribution of Education

India is often cited as having a large cadre of well-educated university graduates. However, overall levels of educational attainment are low compared to the East Asian countries at similar stages of development.[34] An international comparison suggests that India has only now reached an average level of schooling comparable to that achieved in other Asian countries a quarter century earlier (table 8).

TABLE 8. Educational Attainment of the Total Population Aged 15 and Over, Selected Countries and Years
Percent

		Highest Level Attained					*Average years of school*
Country	*Year*	*No schooling*	*Below middle*	*Middle*	*Secondary*	*Post secondary*	
India	1960	72.2	16.2	11.1	0.4	0.0	1.7
	1980	55.0	10.0	23.9	8.6	2.6	2.9
	2000	40.7	9.9	27.1	16.8	5.6	4.5
China	1960						
	1980	34.0	19.5	35.6	10.2	0.6	4.8
	2000	18.0	21.1	43.3	15.5	2.1	6.4
Thailand	1960	36.9	12.7	47.6	2.3	0.4	4.3
	1980	14.4	66.1	12.1	6.4	0.9	4.4
	2000	12.6	34.5	37.9	8.1	7.0	6.5
Malaysia	1960	49.7	25.0	20.5	3.6	1.1	2.9
	1980	26.8	22.2	41.0	8.8	1.1	5.1
	2000	16.2	16.4	48.7	15.8	2.9	6.8
Indonesia	1960	68.0	16.8	14.5	0.8	0.0	1.6
	1980	31.9	33.0	29.3	5.7	0.1	3.7
	2000	32.1	18.2	36.7	12.4	0.5	5.0

Source: Barro and Lee (2000), NSSO various years, and authors' calculations.
Note: Data for India in 1980 and 2000 come from the surveys conducted in 1983–84 and 1999–2000, respectively.

34. Primary education did not become a national policy priority in India until 1986. The National Program of Universal Elementary Education was launched in 2001. (For example, see Wu, Kaul, and Sankar [2005]).

Today, most East Asian countries, including China, maintain a substantial lead over India in terms of the average-years-of-schooling. Using results from the household surveys, table 9 provides a more detailed perspective on the changes in educational attainment of workers since 1960. The first row shows that there has been a substantial reduction in the proportion of the workforce that is illiterate—from 72 percent in the 1961 census. But illiteracy remains high, at about 40 percent currently. Those who have completed secondary schooling account for about 14 percent of workers, while an additional 6 percent have a university degree. Surprisingly, if we limit the analysis to those aged 24–34 in 2004, the proportion with a secondary education or better only rises to 25 percent compared to the 20 percent reported for the full population of working age. It implies a slow rate of educational improvement for younger age cohorts.

TABLE 9. Educational Attainment of Workers Aged 15–64
Percent

Schooling level	*1960*	*1983–84*	*1993–94*	*1999–2000*	*2004*
Illiterate	72.2	56.6	48.5	43.5	39.4
Below Primary	16.2	11.1	12.0	11.0	9.1
Primary		12.8	11.9	11.7	14.5
Middle	11.1	9.6	11.8	14.1	17.1
Secondary	0.4	7.2	7.5	9.3	8.9
Higher Secondary			3.7	4.5	5.1
Graduate	0.0	2.7	4.5	5.9	6.0

Source: NSSO (various years), and authors' calculations.
Note: Data for 1960 reflect educational attainment of all persons 15+.

At the same time, education appears to earn a very good return in India, comparable to that of other strongly growing countries. We obtained the micro household data files of the 38th (1983), 50th (1993–94), 55th (1999–2000), and the 60th (2004) rounds of the NSSO employment surveys. These are large surveys that provide estimates of the earnings of workers (regular and laborers) as well as their educational attainment—measured, as in table 9, by the highest level completed. Regression estimates of the relationship between schooling and earning in each of the four surveys are shown in table 10.[35] A pattern of strongly increasing earnings at each level

35. Our results for the 1983 and 1993–94 surveys are very similar to those of Duraisamy (2000), who used the same two data sets. Dutta (2004) found somewhat lower returns. However, her analysis included other determinants that are likely to be correlated with educational attainment.

TABLE 10. Regressions of Wages on Educational Attainment, 1983–2004

	Survey round			
Coefficient	*#38 (1983)*	*#50 (1993–94)*	*#55 (1999–2000)*	*#60 (2004)*
Below Primary	0.19	0.21	0.22	0.24
Primary	0.31	0.33	0.35	0.34
Middle	0.55	0.52	0.52	0.54
Secondary	1.02	0.91	0.92	0.78
Higher Secondary		1.07	1.14	1.01
Diploma Certificate				1.32
Graduate	1.39	1.37	1.52	1.47
Tech Degree			0.51	0.51
Tech Certificate	0.29	0.27	0.30	0.25
Female	–0.53	–0.44	–0.44	–0.46
Rural	–0.44	–0.33	–0.41	–0.45
Constant	8.44	9.27	5.38	5.52
adj_R^2	0.50	0.40	0.54	0.50
RMSE	0.70	0.86	0.69	0.72
Sample size	87,769	81,038	88,430	42,501

Source: Government of India, National Sample Survey Organization, various years and authors' calculations.

Note: Sample includes all persons aged 15 to 64 who reported positive wages during the reference week. The dependent variable is the log of the weekly wage. Regressions also included categorical variables for sub-round and ten-year age brackets (not shown). The excluded education category is illiterates. All coefficients shown are significant at the.0001 probability level or higher.

of education is clearly evident. Except for some evidence of a decline in the return to a secondary education in the 2004 survey, the magnitudes of the estimated returns are highly stable across time.

We also explored an alternative formulation that replaced the categorical variables with a single index of years of schooling.[36] The estimation results imply an average rate of return that varies between 9.1 and 9.8 percent per year of schooling. For comparison, Psacharapoulus and Patrinos (2004) report an average return to additional schooling across countries of about 10 percent both overall and for the sub-group of Asian economies. However, the returns to schooling in India are not quite as uniform as the log-linear formulation would imply. Table 11 shows the annual marginal returns for different levels of schooling implied by the regression results in table 10.

36. Most states have adopted a system of five years for primary, three for middle school, and two each for secondary and higher secondary. We have treated a university degree as equivalent to three years, and added an additional two years of schooling for those with a technical degree or certificate.

TABLE 11. Implied Incremental Rates of Return by Schooling Level
Percent

	Survey round			
Schooling level	*#38 (1983)*	*#50 (1993–94)*	*#55 (1999–2000)*	*#60 (2004)*
Below Primary	6.3	7.3	7.6	8.0
Primary	4.3	3.9	4.0	3.4
Middle	5.4	4.2	3.8	4.5
Secondary	10.5	14.9	15.4	9.2
Higher Secondary		4.0	5.5	6.2
Graduate	4.3	4.7	5.6	7.1

Source: Computed from the coefficients in table 9: the proportionate change in the coefficient of progressively higher levels of education expressed as an annual rate.

Interestingly, the incremental returns to primary education are significantly lower than the average returns, and there is a large jump in the return associated with completing the secondary level of schooling (10 or 12 years). The additional return to a university degree was low in the 1980s, but it has been rising rapidly in the latest surveys. This is consistent with the view that India may have over-invested in higher education in earlier decades for fields such as engineering, leading to the large diaspora of Indian engineers abroad. The rising return in recent years is reflective of the changed economic situation, and the potential emergence of a scarcity of highly-skilled workers.

These deviations in the return to schooling from a simple log-linear relationship contrast sharply with results for some other countries.[37] Psacharapoulus and Patrinos (2004) report a general global pattern in which the returns are highest for elementary education and decline slightly for higher levels of educational attainment. Those findings have been used to argue for shifting public resources toward primary education and reduction of illiteracy. However, our results would suggest that greater effort should be made to ensure that students complete the secondary education level. In part, the pattern of returns we find can be traced to strong gender effects in the relationship between education and earnings. Women are particularly disadvantaged at low levels of education, but do gain correspondingly

37. The analysis of similar surveys for Thailand found no significant deviation from a log-linear return of 10 percent (Bosworth, 2005). Also, our own analysis of U.S. data suggests a log-linear relationship is an adequate summary of the relationship between earnings and education.

more from secondary and tertiary education. In our analysis, the jump in incremental returns upon completion of the secondary level is particularly pronounced for women.

The finding of a relatively low return to an elementary education is consistent with several recent articles that have been critical of the quality of the primary education system.[38] There has also been a large move from public to private schools; but that may compound the problems as the poor are increasingly isolated and left behind in the process. Kapur and Mehta (2004) offer an even more critical perspective on the system of higher education. They argue that a crisis of governance in the public institutions is forcing students into private educational institutions and to enroll abroad. Such criticisms of India's education system stand in sharp contrast to a generally favorable foreign perspective on the Indian education system, perhaps because a large number of highly-educated persons emigrated. However, the critique raises challenges for a growth strategy that aims to build on economic activities with a large skill component.

Saving and Investment

The small contribution of capital per worker to economic growth evident in the growth accounts highlights important issues about the adequacy of Indian saving and capital accumulation for sustaining high growth in the future. However, several studies have pointed to strongly rising rates of saving and investment shown in the national accounts to argue that capital accumulation should not be a major constraint on future growth.[39] At the same time, the magnitude of recent revisions to the national accounts also raises questions about the reliability of the saving and investment data and the extent to which they reflect the underlying reality (Shetty, 2006). In this section, we address these issues, beginning once again with a discussion of the data available for analysis.

In the Indian national accounts, total national saving is the sum of three separately-compiled components: (1) public sector saving, (2) corporate saving and (3) household (including non-corporate enterprises) saving.

$$S_T = S_{pub} + S_c + S_h. \tag{6}$$

38. See Kochar (2002), and Kremer and others (2005). Psacharapoulus and Patrinos (2004) also report a surprisingly low return to primary education of 3 percent. See also the paper by Pritchett and Mugai in this volume.

39. See, for example, Mühleisen (1997) and Rodrik and Subramanian (2004b).

The CSO can construct reasonably good estimates of public sector saving from budget records. Its measure of corporate saving is compiled from a sample of major corporations' income and balance sheets, maintained by the Reserve Bank of India. The difficult measurement issues are associated with saving of the household sector. Household saving consists of two independently-estimated components: physical saving, and net financial saving. Saving in physical assets is simply set equal to investment of the household sector, which is itself a residual estimate, as explained below. The estimate of household financial saving is constructed from flow-of-funds measures of the net addition to total financial assets less the net financial saving of the public and corporate sectors.

The overall national saving rate and its three components are shown as percentages of GDP for the period 1970–2004 in figure 3a. The overall saving rate has risen strongly, especially since the mid 1980s. Further, this increase is dominated by major gains in household saving. Public sector saving actually turned negative in the late 1990s, but it has improved in recent years. Corporate saving (retained earnings) grew substantially up to 1995, but has since remained in the range of 4–5 percent of GDP.

FIGURE 3a. Gross National Saving by Sector, 1970–2004

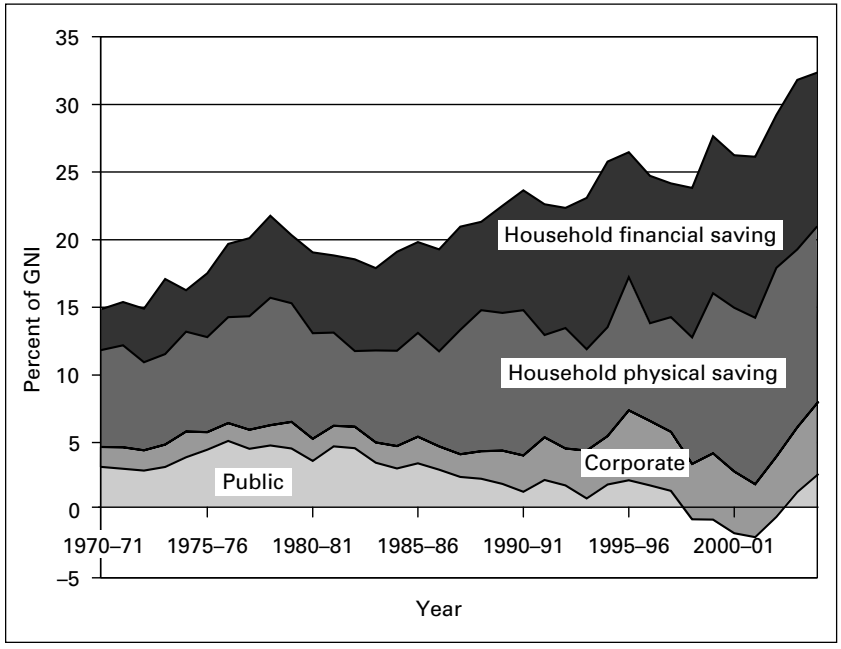
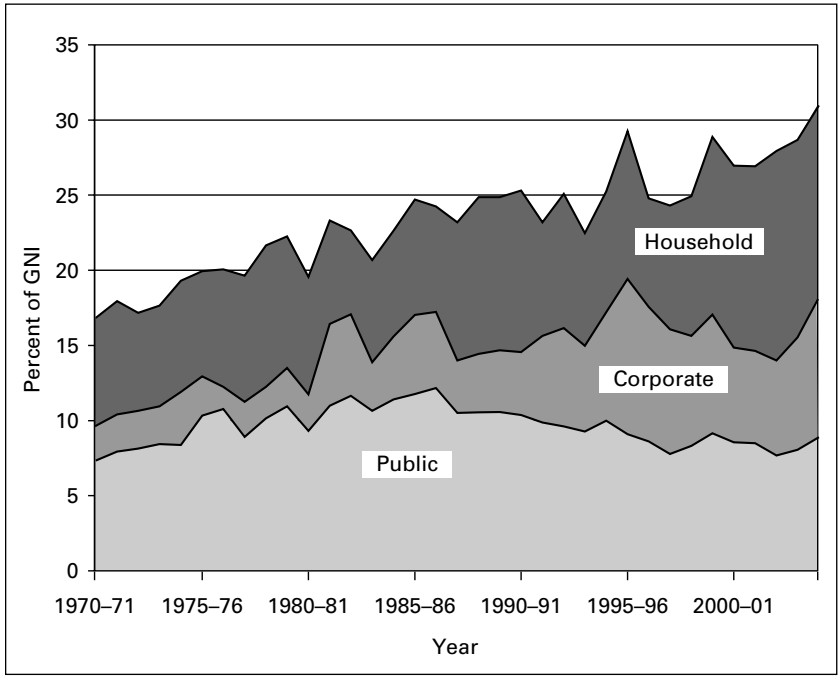


FIGURE 3b. Capital Formation by Sector, 1970–2004



Thus, the expansion of saving is concentrated in the household sector. Total household saving has increased from a modest 10 percent of GDP in the early 1970s to 25 percent today. Furthermore, in the 1970s, over two-thirds of household saving was in physical saving, implying that it was dominated by housing and own-account construction, much of which never passed through financial institutions. (An unknown portion represents the investment of unincorporated business that are included as part of the household sector.) The most impressive growth has been in the category of financial saving, which increased from about 4 percent of GDP in the early 1970s to 12 percent in recent years and now represents half of household saving. These funds are available to finance investment in other sectors.

The estimates for 2004–05 and preliminary indicators for 2005–06 imply that household saving has recently declined slightly as a share of GDP. These data are subject to substantial revision, but the falloff is consistent with the rapid growth in consumer credit during the same period. It may be that this is a transitional response to the introduction of new consumer debt products, but it makes any projections of the future trend quite uncertain.

On the investment side, the CSO constructs two direct measures. The first is an estimate of *total* investment derived using the commodity flow method. Under that method, the total supply of goods by commodity line is estimated as the sum of domestic production and imports. It is then apportioned among intermediate inputs and the various components of final demand, such as consumption, exports, and investment. The process is similar to that utilized to construct input-output tables. Of necessity, many of the demand components and some of the elements of domestic production must be estimated using various fixed ratios. For both the public sector and private corporations, investment is derived from the same sources used to estimate their saving. Household investment is then obtained as a residual by subtracting public and corporate investment from the total. Thus, household investment (physical saving) reflects all of the potential for error in the estimation of total investment expenditures as well as the errors in the estimation of government and corporate saving. For example, it is alleged that many of the ratios used to allocate commodity output among the various expenditure components are seriously out of date.

A second direct estimate of capital accumulation is built up from individual industries, based largely on the expenditure approach in which information is obtained from buyers rather than producers. Measures of both fixed investment and inventory accumulation are constructed from a variety of sources, including surveys, public budget documents, and annual reports of public and private enterprises. Given the importance of the unorganized sector, this second set of estimates is particularly tenuous—but they provide the only information on the distribution of investment at the industry level.

Finally, by combining the estimate of national saving with the current account balance of the balance of payments (CA), the CSO can derive still a third indirect measure of total investment:

$$I_T = S_T - CA. \tag{7}$$

Thus, the CSO actually has three alternative measures of aggregate capital accumulation that are semi-independent of one another. Prior to the last revision (1999–00 base), all three measures were published with their associated discrepancies. The CSO views the valuation from the saving side (equation 7) as the most reliable and emphasizes it in their publications. The various measures of investment and saving are shown for the period of 1960 to 2004 in appendix table A-2.

With the introduction of the 1999–2000 base, the CSO made several changes to its calculation and presentation of the alternative measures of capital formation. First, the definition of capital accumulation has been changed to include an estimate of net purchases of valuables, such as jewelry.[40] By 2004–05, these purchases represented 1.4 percent of GNI. However, no comparable change was made to include valuables on the saving side. Since the saving-side measure of capital accumulation has been the larger in recent years, this definitional change had the effect of sharply reducing the magnitude of the reported discrepancy between the saving and the commodity-flow measures of capital accumulation. However, we have retained the old treatment and excluded valuables from our measure of productive capital in the growth accounts.

Second, the CSO elected to eliminate the second discrepancy between the commodity-flow and industry-based estimates by distributing the discrepancy across the industry groups in proportion to their estimated levels of investment. The result was a dramatic upward adjustment of the industry-based investment of 30 percent for 1999–2000.[41] A previous pattern of a declining rate of investment—particularly within industry—was converted into a strongly rising trend. We integrated the new 1999–2000 and subsequent estimates of both saving and investment into the historical data by phasing the changes in between 1993–94 and 1999–2000, the same procedure that was used to link in the revisions to the other GDP data.

The composition of investment by institutional sector is shown in figure 3b. In a comparison with figure 3a, it is readily evident that the investment of both private corporations and the public sector is much larger than their own saving. The household sector has become an important source of finance for the rest of the economy. In addition, the growth of overall investment is concentrated in households and corporations, while public sector investment has been a consistently declining share of GDP. The increase in the household sector is largely due to the growing importance of private noncorporate enterprises. While there was a substantial upward revaluation of real estate investment (concentrated in the household sector) in the 1999–2000 revisions, the growth in household investment is substantially larger.[42]

40. The accounts also adopted the suggestion of the 1993 SNA to include purchases of computer software, but the accounts do not include the development of own-account software and databases as investment.

41. The revision to the commodity-flow estimate was a more modest 12 percent.

42. As discussed in the section on growth accounts, the national accounts do not currently separate investment of the business services industry from that of real estate investment. That is unfortunate given the interest in the rapidly expanding business services industry.

Additional information on the role of the public sector is given in table 12. First, the historically low rate of public saving has primarily been due to the large dissaving in the administrative budget, not public enterprises. The shortfall of revenues relative to current outlays first emerged in the mid-1980s and then grew steadily over the years. After peaking in 2001–02 at 6.6 percent of GNI, the administrative budget deficit has been cut in half in recent years. Saving within public enterprises has increased over the past decade, so that total public sector saving turned positive in 2003–04.

TABLE 12. Saving and Investment of the Public Sector, 1970–2004
Percent of GNI

	1970–79	*1980–84*	*1985–89*	*1990–94*	*1995–99*	*2000–04*
Public sector saving	3.7	3.7	2.4	1.4	0.6	–0.3
Administration	2.0	1.4	–1.2	–2.0	–3.3	–5.1
Other public	1.7	2.3	3.6	3.4	3.9	4.8
Public sector investment	8.2	9.9	10.2	8.9	7.7	7.4
Administration	1.4	1.6	1.6	1.4	1.2	2.0
Other public	6.8	8.3	8.6	7.5	6.2	5.5
Puiblic sector net lending	–4.5	–6.2	–7.8	–7.5	–7.1	–7.7
Administration	0.6	–0.2	–2.8	–3.3	–4.5	–7.0
Other public	–5.1	–6.0	–5.0	–4.2	–2.3	–0.6
Addenda:						
Infrastructure investment	4.2	4.8	5.5	5.6	5.2	5.7

Source: appendix table A-2.
Note: Infrastucture investment includes investment of public utilities and the transportation and communication industries.

Investment of public enterprises did rise significantly in the 1980s—a point made by those who point to demand stimulus as a cause of the acceleration of growth in the 1980s.[43] However, enterprise investment was steadily cut back after the surge of the 1980s. Investment in the administrative budget has remained very low in recent years—between one and two percent of GNI. This reflects a longstanding lack of attention to infrastructure needs, particularly road building. Some other types of infrastructure investment are captured in the industry data for public utilities, transportation and communications, shown as an addendum to table 12. Again, this type of investment has also remained low as a share of GNI.

Some of the increase in the rate of gross investment that has taken place over the last quarter century has been offset by a rise in capital consumption allowances as a share of GDP, the result of a shift in investment toward

43. See Srinivasan (2003b) and Buiter and Patel (1992).

shorter lived machinery. During the latest 5-year period (2000–04), net investment has averaged 17 percent of GDP (appendix table A-2). At the same time, the aggregate capital-output ratio has also been a stable 2.5 times GDP, suggesting that the current rate of capital formation is sufficient to support a growth rate of 6–7 percent per annum.

Is saving constraining India's growth? To the contrary, we think the evidence suggests a higher potential growth rate should be quite feasible. First, the private saving rate appears to be rising over time.[44] Second, India should be able to support a significantly higher rate of foreign saving (current account deficit), particularly if this were financed by higher rates of FDI. Third, there continues to be substantial room for improving the saving performance of the public sector.[45]

As an additional reason for believing that current rates of saving are adequate to support future growth, we note that we can find little evidence of heightened competition for domestic capital. We constructed a lending rate by averaging the rates of four major lending institutions, as reported by the Reserve Bank of India (RBI). A real interest rate was computed on an annual basis using the ex-post realized rate of increase in the Wholesale Price Index. These data are summarized in table 13. While the real rate shows considerable fluctuation, there is little evidence of a secular rise. Although the rate rose in the late 1990s, it appears to have been a transitory response to a sharp decline in the inflation rate. Furthermore, a real interest rate in the range of 5–7 percent is not particularly high for a developing country.

TABLE 13. Nominal and Real Lending Rates, 1970–2004

Year	*1970–74*	*1975–79*	*1980–84*	*1985–89*	*1990–94*	*1995–99*	*2000–04*
Nominal lending rate	9.0	10.4	13.3	13.9	16.7	15.2	11.4
Inflation rate	15.3	4.7	9.3	6.7	11.0	5.3	5.2
Real interest rate	–4.9	5.9	3.9	6.8	5.2	9.4	5.9

Source: Reserve Bank of India (2006), tables 70 and 169.

Note: The nominal lending rate is an average of the rates for four major lending institutions. The inflation rate is measured by the annual rate of change in the wholesale price index for all commodities.

44. Several international studies of saving in developing countries conclude that there is a strong positive association with the level of income. For a discussion see Mühleisen (1997), and Loayza and others (2000). See Loyaza and Shankar (2000) for a discussion of India's experience. Also, India's demographic trends support the notion of continued increases in private saving (Higgins and Williamson, 1997).

45. See Mitra (2006) for further discussion of these points.

Overall, this evidence suggests to us that the low contribution of capital accumulation to growth has largely been a product of weak incentives to undertake investment, rather than a saving constraint. Mary Hallward-Driemeier (2005) provides a recent overview of the literature on business climate and its implications for investment and private sector activity. Referring to the World Bank's survey based indicators—"Doing Business"—she finds that India ranks in the bottom 25 percent of countries. The survey highlights the firms' concerns, including poor access to electricity, and stringent labor regulations. The public sector, in particular, has not responded to obvious signs of insufficient infrastructure capital.

Implications for the Future

India is still a very poor economy, and increasing overall living standards is clearly the major priority. To achieve this, it will be necessary both to raise labor productivity, and to speed up the pace of job creation for those currently underemployed in rural agriculture. Our analysis in prior sections points to three implications for achieving this critical objective. While we are certainly not the first to highlight the issues below, we believe our analysis sheds additional light on the reasons for their importance.

First India must broaden the base of the economic expansion beyond the modern service sector, which, by itself, can not provide the requisite number of job opportunities. This point is cogently argued by Panagariya (2005) among others. Studies, such as Virmani (2005) and Kochhar et. al. (2006), have documented unusual features in India's development pattern to date, especially compared with other high growth Asian economies. These include a relatively low share of manufactures in GDP, a high share of employment in agriculture, and a somewhat surprising concentration of manufacturing (and services) in skill-intensive output. What is needed is a much more rapid expansion of the manufacturing sector, which will require strengthening India's infrastructure, raising private sector investment and adopting an aggressive approach to expanding India's export markets for goods.[46]

Second, India must accelerate the pace of improvements in the educational attainment of the population. As discussed above, this requires a

46. Hulten, Bennathan and Srinivasan (2006) assess the importance of infrastructure for Indian manufacturing growth. Other relevant work includes World Bank (2002, 2004). Hallward-Driemeier (2006) and Dollar, Iarossi and Mengistae (2002) provide analyses of India's investment climate.

greater emphasis on increasing primary and secondary schooling, as well as expanding its already substantial pool of highly educated labor.

A third implication of our work is good news—India has strong prospects for increasing the saving necessary to finance the additional capital accumulation. It is true that the overall saving rate has not been as impressive as that of the high-growth East Asian economics. However, India's *private* saving rate has grown rapidly.[47] As incomes increase, experience elsewhere suggests that India's private saving should be expected to increase somewhat further. Equally important, India has considerable scope for raising foreign saving through increased FDI. To date India has received little of the very substantial global FDI flows to developing countries. Virmani (2005) notes that during 1980–2003, FDI flows averaged only 0.3 percent of India's GDP, putting India in the 7th percentile of his sample of 82 medium and large countries. Despite some recent liberalization, India's ranking remains near the bottom of such indicators. Estimates of the stock of FDI assets by country constructed by Philip Lane and Gian-Maria Milesi Ferretti show that as a share of GDP India's FDI stock is less than one fifth that for China.[48]

Concerns about the adequacy of national saving are centered on the behavior of the public sector. As discussed above, the public saving rate has fallen dramatically over the past twenty years. In part, this reflects a deteriorating situation within the public enterprises, requiring substantial subsidies and other transfers from the central administrative budget. In addition, central administrative budget deficits have become endemic.

Finally, the lack of reliable annual statistics on employment is a major limitation on efforts to evaluate current economic performance. Thus, we believe that India needs to undertake an ongoing household survey that would provide annual time-consistent measures of labor-market performance. The assessment of India's economic performance is made difficult by the lack of statistical coverage of large portions of the economy. In particular, there is no consistent information on employment between the quinquennial surveys. At a minimum, India needs an annual survey for the intervening years. The quality of the quinquennial surveys appears to be high, but the development of the sample frame for each survey is a major undertaking. In addition, by constructing a large portion of the sample frame as a new undertaking for each survey, the results have suffered from a lack of consistency over time. We believe that the maintenance and continued use of the

47. For example, see Loayza and Shankar (2000).

48. Lane and Milesi-Ferretti (2006). Their data are available at http://www.ssc.wisc.edu/~cengel/CAConference/WP_External%20Wealth_final.pdf

sample frame from the quinquennial survey over the following five years would provide a relatively low cost means of obtaining time-consistent employment data.

Concluding Remarks

In this paper, we have revisited some of the key issues regarding India's economic growth performance and prospects. Our work updates previous studies and presents results based on analysis of new data. Our analysis focuses on the periods de-lineated by the quinquennial surveys, conducted in: 1973, 1983, 1987, 1993, 1999 and 2004. We have argued that researchers should have a reasonable degree of confidence in the GDP estimates for benchmark years. However, for non-benchmark years, annual output data are based on interpolation and extrapolation of the labor input data required to construct output measures for India's large unorganized sector. These estimates have been subject to substantial revisions. We conclude that the lack of reliable annual series make it impossible to pin down the precise timing of India's growth acceleration. Although it does seem clear that growth accelerated in the years after 1973, the precise timing and the triggering events remain topics of on-going debate.

It is clear, however, that India is enjoying a large and sustained acceleration of economic growth: from an average of about 3 percent per year in the years prior to 1973 to 6–7 percent over the past decade. Prior to 1973, growth was limited to increases in the factor inputs; but in subsequent decades, the contribution of improvements in the efficiency of input use, TFP, has grown in importance.

Considerable attention has been focused on the role of services—especially high-tech services—as the source of India's growth. Our growth accounts attribute 1.3 percentage points of the 3.8 percent per annum growth in GDP per worker during 1980–2004 to growth in total services productivity (versus 0.7 percentage points each to agriculture and industry and 1 percent to reallocation, respectively). However, the very strong gains in service sector TFP are also puzzling. One might expect such rapid productivity growth in sub-sectors such as finance and business services, but these sectors remain small—just 17 percent of total services output in 2004. In fact, the growth acceleration is quite widely dispersed across service sub-sectors. But rapid productivity growth seems unlikely in the biggest, which are trade, transportation and community services. Though difficult to verify,

we are concerned that output growth in services has been overstated, perhaps due to an underestimate of services price inflation, particularly in the more traditional sectors. The available measures of employment suggest a less dramatic acceleration of overall growth and a somewhat smaller focus on services.

The accounting decomposition finds that the growth contribution from increases in education has been quite modest. While India can boast a relatively large share of highly educated workers for its income level, average years of schooling and literacy rates among its population remain low, and the effort to achieve universal primary education is quite recent. Not only does India have a long way to go to catch up with competitors such as China, the rapid increase in school enrollments appears to have exacerbated concerns about educational quality—particularly in poorer regions. The growth accounts show that capital deepening has also made only a small contribution to growth—despite the recent data revisions that have substantially increased measured investment since 1993.

We also examine the evolution of India's saving behavior, to explore whether saving is likely to constrain India's investment. We argue that private saving in India has performed remarkably well. The rise is concentrated among households, who now save fully 25 percent of GDP. Further, nearly half of household saving is in the form of financial saving, available to fund corporate or public investment. However, public sector saving has been very low historically, turning negative during the late 1990s, before recovering somewhat more recently. We conclude that saving is not constraining India's growth. There is room for increased public saving, as well as a rise in foreign saving, particularly if financed through FDI which remains quite low in India.

Pulling together the findings of our analysis we draw a number of implications for India's growth in the coming decade. Our starting point is that improving living standards in India will require a combination of increasing employment and raising labor productivity. To date, accelerated output growth has been associated with a modest improvement in overall rates of job creation. And while agricultural output has fallen as a share of GDP, its share of total employment remains surprisingly high. We find that labor productivity in agriculture is just one-fifth that in either industry or services, implying significant productivity gains from further sectoral reallocation of labor.

Thus, India needs to broaden the base of its economic growth through greater efforts to promote the expansion of the industrial sector—especially manufacturing—and to emphasize the creation of jobs as well as gains in

TFP. In this context, China provides a useful model, in its emphasis on exports manufactured under foreign contract as a primary driver for growth. One key attraction to this strategy is that it provided rapidly expanding employment opportunities for relatively young, and low-skilled workers. A second is that it generated large feedback effects for the domestic economy—both in promoting linkages to the supplying industries (including services) and in developing local expertise for doing business in a global market.

To follow this strategy, India needs to create a more attractive economic environment for doing business—a location able to compete effectively with China. This will require strengthening its infrastructure—including a weak and unreliable power system, and poor land transportation in many states. However, compared with China, India already enjoys relatively good institutions and is strong in the areas of finance and business services.

Finally, we stress that successful implementation of this growth strategy should not be expected to generate rapid TFP growth within the growing sectors. Expansion of both industry and services will draw workers out of agriculture. This will generate gains in aggregate TFP from the reallocation of labor to higher productivity activities and from reduced labor redundancy in agriculture. Thus, reforms should be directed towards making it easier to expand domestic production, and creating a more attractive location for global business. We see strong prospects for sustaining this broad-based type of high growth in India.

APPENDIX

TABLE A-1. Data Used to Compute Workforce, 1973–04

		Usually employed			
		Male		*Female*	
Round	*Date*	*ps*	*all*	*ps*	*all*
		Worker participation rates, per 1000 persons			
			Rural		
27	1-Apr-73		545		318
32	1-Jan-78	537	552	248	331
38	1-Jul-83	528	547	248	340
43	1-Jan-88	517	539	245	323
50	1-Jan-94	538	553	234	328
55	1-Jan-00	522	531	231	299
61	1-Jan-05	535	546	242	327

(Table A-1 continued)

(Table A-1 continued)

		Usually employed			
		Male		*Female*	
Round	*Date*	*ps*	*all*	*ps*	*all*
			Urban		
27	1-Apr-73		501		134
32	1-Jan-78	497	508	123	156
38	1-Jul-83	500	512	120	151
43	1-Jan-88	496	506	118	152
50	1-Jan-94	513	521	121	155
55	1-Jan-00	513	518	117	139
61	1-Jan-05	541	549	135	166
		Population (millions)			
		Rural		*Urban*	
		Male	*Female*	*Male*	*Female*
27	1-Apr-73	233.6	221.7	63.3	54.6
32	1-Jan-78	254.4	241.7	75.6	65.9
38	1-Jul-83	280.6	266.0	91.1	80.4
43	1-Jan-88	305.5	287.9	104.4	92.8
50	1-Jan-94	339.4	319.4	124.0	111.1
55	1-Jan-00	374.4	353.8	145.9	131.2
61	1-Jan-05	400.4	378.7	164.4	148.0
		Workforce (millions)			
		Rural		*Urban*	
	Mid round	*Male*	*Female*	*Male*	*Female*
27	1-Apr-73	127.3	70.5	31.7	7.3
32	1-Jan-78	140.4	80.0	38.4	10.3
38	1-Jul-83	153.5	90.5	46.6	12.1
43	1-Jan-88	164.7	93.0	52.8	14.1
50	1-Jan-94	187.7	104.8	64.6	17.2
55	1-Jan-00	198.8	105.8	75.6	18.2
61	1-Jan-05	218.6	123.8	90.2	24.6

Sources: Worker participation rates, NSSO (2006) table 5.1, p. 76; Population, 1973–88 data from Visaria (202), p13; later years from Sundaram and Tedulkar (2005a) table 1, 2005 from census projections. Workforce, computed by authors.

TABLE A-2. Components of Saving and Invesment Balance, 1960–2004

Percent of GNI

Year	*1960–69*	*1970–79*	*1980–84*	*1985–89*	*1990–94*	*1995–99*	*2000–04*	*2000–01*	*2001–02*	*2002–03*	*2003–04*	*2004–05*
Gross domestic saving	12.7	17.6	18.5	20.5	23.3	25.3	28.9	26.0	25.9	29.0	31.6	32.1
Household Sector	8.5	12.3	13.2	16.2	18.7	19.9	24.6	23.4	24.2	25.3	25.7	24.3
Financial savings	2.7	4.6	6.4	7.3	10.2	10.5	11.7	11.3	11.9	11.3	12.5	11.4
Physical savings	5.7	7.7	6.8	8.9	8.6	9.3	12.9	12.1	12.3	13.9	13.2	13.0
Private corporate sector	1.5	1.6	1.6	2.0	3.1	4.7	4.6	4.6	3.9	4.5	4.8	5.3
Public Sector	2.8	3.7	3.7	2.4	1.4	0.6	–0.3	–1.9	–2.2	–0.7	1.1	2.5
Administration	1.4	2.0	1.4	–1.2	–2.0	–3.3	–5.1	–6.1	–6.6	–5.7	–4.0	–3.0
Other	1.4	1.7	2.3	3.6	3.4	3.9	4.8	4.1	4.4	5.0	5.1	5.4
External Investment (current account)	–2.0	–0.1	–1.4	–2.4	–1.5	–1.4	0.4	–0.7	0.7	1.3	1.8	–1.1
Total capital formation	14.8	17.7	19.8	22.9	24.8	26.6	28.5	26.7	25.2	27.7	29.8	33.2
Errors and Omissions	–0.7	–0.6	–1.0	–0.6	1.4	1.1	1.2	0.6	–0.8	0.7	2.0	3.2
Unadjusted capital formation	15.5	18.3	20.9	23.5	23.3	25.5	27.4	26.0	26.0	27.0	27.8	30.0
Public sector	7.0	8.2	9.9	10.2	8.9	7.7	7.4	7.6	7.6	6.8	7.1	8.0
Administration	1.4	1.4	1.6	1.6	1.4	1.2	2.0	1.8	1.6	1.9	2.1	2.4
Other public	5.6	6.8	8.3	8.6	7.5	6.2	5.5	5.9	6.0	4.8	5.0	5.6
Private crporate sector	2.8	2.4	4.1	4.4	5.9	8.6	7.1	6.3	6.1	6.3	7.5	9.1
Household sector	5.7	7.7	6.8	8.9	8.6	9.3	12.9	12.1	12.3	13.9	13.2	13.0
Valuables					0.1	0.4	0.9	0.8	0.7	0.6	1.0	1.4

(Table A-2 continued)

(Table A-2 continued)

Year	*1960–69*	*1970–79*	*1980–84*	*1985–89*	*1990–94*	*1995–99*	*2000–04*	*2000–01*	*2001–02*	*2002–03*	*2003–04*	*2004–05*
Industry basis	**15.8**	**18.8**	**22.6**	**23.8**	**22.1**	**27.3**	**27.4**	**26.0**	**26.0**	**27.0**	**27.8**	30.0
Ariculture	2.0	2.7	2.6	2.2	2.0	2.4	2.6	2.4	2.9	2.8	2.6	2.4
Industry	7.1	8.9	11.9	12.7	11.9	14.4	11.3	10.6	8.9	10.5	12.4	13.9
Services	6.7	7.2	8.1	8.9	9.5	11.1	13.5	13.0	14.2	13.7	12.8	13.7
Real estate	1.4	1.4	2.0	2.1	2.5	3.7	4.5	3.9	5.2	5.3	4.3	3.8
Capital consumption allowances	6.0	7.3	8.9	9.7	9.9	10.4	10.5	10.6	10.6	10.5	10.2	10.4
Infrastucture Investment	4.0	4.2	4.8	5.5	5.6	5.2	5.7	6.1	5.2	5.5	5.4	6.2
Fixed Investment - asset	14.1	15.9	19.1	21.6	22.6	24.6	26.5	25.1	25.4	26.3	27.0	28.6
Fixed investment - industry	14.4	16.3	20.8	22.0	22.6	26.6	26.5	25.1	25.4	26.3	27.0	28.6

Source: CSO (2006) and prior years.

Data include the revisions publised in the 1999–2000 base year revisions, but total capital formation redefined to exclude valuables.

Comments and Discussion

Shankar Acharya: This is an interesting paper, which covers a lot of ground and raises some important empirical and policy issues. I broadly agree with the major themes and findings of the paper. Precisely because it covers a lot of ground (some of it well-trodden) it might have been helpful if the authors had focused a little more on delineating more clearly their fresh contributions and comparing them with earlier work. My comments focus on the parts of the paper which interested me most.

Sources of Growth Analysis

I welcome the paper's constructive criticisms of Indian economic data, especially those relating to national income and employment. One wishes that more analysts spent as much time and effort in assessing the basic data deployed in their analyses. The underlying infirmities in the available data lead Bosworth-Collins-Virmani (henceforth, BCV) to give special weight to the (approximately) quinquennial "benchmark years", for which detailed surveys are available for applying the "labour input" method of estimating unorganized sector output and value added. That is why in the sub-periodization for their sources of growth analysis they prefer to deploy the benchmark years as "bookends" for their chosen sub-periods.

There is certainly appealing logic to their approach. But it does distract attention from alternative schemes of sub-periodization based on different criteria, such as policy regimes. For example, in some earlier work we (Acharya-Ahluwalia-Krishna-Patnaik, 2003) had divided up India's half century of growth experience (1950–2000) into four sub-periods (1950–66, 1967–80, 1980s and 1990s) on a prior identification of major policy shifts and major shocks. On that basis we found somewhat different trends in total factor productivity from those estimated here by BCV (their table 3). They find continuously rising TFPG rates between 1960 and 1999, whereas we found that TFPG first fell (in 1967–80) and then rebounded strongly in the next two decades. It would have been interesting to benefit from BCV's comment on such differing productivity trends.

More generally, I welcome the attention and space the authors devote to disaggregating the rise in productivity due to reallocation of labor and capital across sectors, specifically from low-productivity agriculture to higher productivity industry and services. It is standard stuff but too often neglected. The authors are to be congratulated for not doing so.

Services: Growth and Productivity

I warmly welcome BCV's focus on and cautionary remarks about growth of services in India and related issues of data reliability and sustainability. This is especially important given the unusually high and rising share of services in India's GDP and its growth. For the past five years or so I have been a somewhat lonely voice pointing to the unusual (and possibly unlikely) pace and pattern of services growth in India. For example, Acharya (2002, p. 1516), commenting on India's growth pre and post the 1991 crisis, noted:

"In both the pre-crisis decade and the post-crisis quinquennium services accounted for a little under half of GDP growth. For the full nine years, post-crisis, the growth-contributing role of services was almost 60 percent. Even more remarkably, the proportion rose to nearly 70 percent in the last four years. Without wishing to be labeled as a commodity-fetishist, this kind of numbers surely raises genuine issues of both plausibility and sustainability."

It's good to have BCV join one's corner in this ongoing debate, although they are surely mistaken in dating the services sector surge as beginning in 1980. It's much more a post-1996/7 phenomenon. BCV's own analysis shows this, when they are rightly skeptical of their findings of labor productivity growth of 7 percent per year and TFP growth of nearly 5 percent in services in the latter part of the 1990s. They go on to hypothesize overestimation of services real value added (in the official data) for some reason including, possibly, under-estimation of inflation in many traditional service activities such as trade, transportation and community services.

Let me draw BCV's attention to some cross-country data to reinforce their skepticism. Some years ago I looked at comparative growth performance of developing countries over a longish, 35 year period, 1965–2000. It was interesting to find that in not one of the seven fastest growing economies of that period did services grow faster than industry (see Acharya (2003), especially chapters 3 and 5). This was in marked contrast to post-1996/7 growth in India, especially during the Ninth Plan period 1997–2002,

when services growth averaged 8.2 percent and industry grew much slower at 4.4 percent. This kind of anomaly had led me to two conclusions, which BCV appear to share: possible over-estimation of services value added and growth in recent years; and the more important policy lesson that if India wants long-term rapid economic growth, industry and agriculture also have to grow fast.

Policies for the Future

BCV's general policy advice for sustaining rapid growth is unexceptional and easy to agree with: "India needs to broaden the base of its economic growth through greater efforts to promote the expansion of the industrial sector—especially manufacturing—and to emphasize the creation of jobs as well as gains in TFP." That's pretty well accepted here in India. The issue is how to set about it. BCV do not go beyond recommending better infrastructure and a more attractive investment climate. Given the empirical focus of their paper, this is perhaps fair enough.

In fact, the menu of desirable policy reforms to serve the broad objective is well-known (see, for example, Acharya (2006) and Panagariya (2006)). It includes: reform of labour laws, abolition of small-scale industry "reservations", further trade policy reforms, fiscal discipline, revitalization of a sluggish agricultural sector and privatization of government enterprises in energy, banking, transport and communications. The difficult task ahead is to get these reforms implemented.

Rajnish Mehra: I specially thank Jean Pierre Danthine, John Donaldson, Marek Kapicka, Krishna Kumar and Edward Prescott for their insightful comments, many of which are incorporated in this discussion. I am also grateful to the participants of the India Policy Forum Conference for a stimulating discussion. I remain responsible for any errors.

Introduction

In this thought-provoking paper, the authors raise several interesting issues regarding the empirics of growth in India. Their analysis builds on their earlier work and on the study by Sivasubramonian (2004). I want to use this discussion to highlight some of the issues raised in the paper.

The paper is an exercise in Growth Accounting—a task that is challenging to undertake in India due to a large informal sector, major statistical revisions and a lack of systematic annual surveys. The paper brings quantitative rigor to bear upon assertions that have heretofore been part of conventional wisdom. Its basic conclusions are:

a. India's success has not been based on strong growth in the manufacturing sector.
b. The success is a result of a rapid expansion in service producing industries.
c. Physical capital accumulation has not been impressive.
d. Illiteracy remains high.

The paper is agnostic in identifying the takeoff year for Indian economy. Given the major revisions that have been undertaken to the National Accounts, I believe that this is the correct perspective.[1]

Methodological Issues

The paper starts out by presenting a general production formulation with time varying shares. However, the framework for analysis that is ultimately used is standard Cobb-Douglas with fixed shares and constant returns to scale. For example, for the agricultural sector the functional form used is:

$$y_A = Ak_1^{\alpha_1} k_2^{\alpha_2} l^{\alpha_3}$$
k_1 : capital
k_2 : land
l : labor

with shares $\alpha_1 = 0.25$, $\alpha_2 = 0.25$, and $\alpha_3 = 0.5$. For the industrial and service sector the shares are $\alpha_1 = 0.4$, $\alpha_2 = 0$, and $\alpha_3 = 0.6$.

I have some reservations regarding the authors' methodology. They use fixed factor shares, which may be appropriate for analyzing advanced industrial economies (which presumably are in "steady state") but this mode of analysis does not readily translate to an economy in transition. Further, abstracting from returns to scale very likely overstates TFP.

1. These revisions are probably responsible for the current debate between Rodrik and Subramanian (2005) and others.

There is a well-established literature documenting the importance of taxes as a factor in investment and labor supply decisions. Thus, it is surprising to see no analysis regarding the role of taxes and other distortions, in this paper.[2]

From the perspective of neoclassical growth theory, one can analyze economic growth and identify anomalies by undertaking two related, but in principle distinct, exercises. The first examines whether changes in employment, investment or capital accumulation are consistent with a given TFP growth rate while the second is an analysis of the TFP growth rate itself. The distinction is important, because each has a different methodology and different results. The paper would have benefited from drawing a distinction between these two exercises. For example, to analyze the problem of changes in employment, investment or capital stock, one should compute the growth model for a given time path of TFP. Conclusions such as "India's priority is to generate employment in industry" could be misleading because industry employment may in fact be optimal, *given the TFP in industry*.

Similarly, the conclusion that "(it is a) surprise that agricultural employment continues to grow" may be misleading. Hayashi and Prescott (2006) found a similar pattern of agricultural growth in Japan prior to the Second World War.[3] They attributed this to the sizeable transaction costs of moving from agriculture to other sectors. It would be interesting to compare results and see, for instance, whether the implied transaction costs in pre-war Japan and current day India are of similar magnitudes. This issue may be related to the problem of low educational attainment. If, for example, the transaction costs of moving from agriculture are high, there are fewer incentives to invest in education.

In the absence of a well-established theory of TFP, one typically needs to resort to anecdotal evidence to do the second exercise and identify puzzles in TFP growth. For example, I would expect the liberalization reforms in the 1980's and 1990's to be related to increases in TFP. The authors compare changes in services across various East Asian countries and conclude that the TFP growth in services is puzzlingly high. It would make sense to likewise compare TFP growth rates across East Asian countries.

Meaningful price level deflators are a crucial parameter input for growth accounting. The lack of a comprehensive price index in India that adjusts

2. See the section on 'A Puzzle' in this discussion.

3. I thank Marek Kapicka for bringing this to my attention.

for quality and technical innovation is a major impediment in this context. The authors do not discuss this important issue in any substantive way. Typically, the inflation rate for different sectors varies, often considerably. This could potentially bias reported growth rates; in particular, the growth rate for the service sector may be overstated. This is especially likely to be the case in a sub-period where there was a substantial pay increase for the civil service or the public sector, or where there was general wage inflation due to a skill shortage.

This is documented by Young (2004) for the Chinese economy. After correcting for what he believes to be a systematic understatement of inflation, Young recalculates growth rates and concludes that from 1986 to 1998, they averaged 6.2 percent per year, "3 percent less than the officially reported figures of 9.2 percent."

The paper documents an interesting finding that unlike in other countries productivity growth in agriculture has been higher than in industry for most sub-periods documented in table 5.[4] On the face of it, this suggests that the reallocation of workers from farms to industry could, at the margin, have an adverse effect on overall growth. However, this conclusion is probably incorrect since the *level* of productivity is likely to be higher in industry.

On the other hand, since both the productivity level and growth rates are higher in services than industry, farmers should switch to services instead of manufacturing. Almost all developed countries have seen a shift toward services and India is experiencing this at even lower levels of income. Why not capitalize on this rather than turn to manufacturing for growth?[5] The authors argue that the service sector is unable to generate sufficient employment or incentives for education. On the contrary, a large return to human capital will induce more accumulation and growth; there are gains from specialization and India is specializing!

A Puzzle

The low level of investment and investment growth in India relative to other developing countries is a puzzle. Given the large labor pool and respect for property rights, neoclassical economic theory would predict that rates of return on capital would be high with a concomitant high level of investment. Why then has the level and growth rate of investment been disappointing?

4. A notable exception is the period 1999–2004.
5. See the section on Social Instability, below, for a non-economic reason.

One way to address this would be to undertake an exercise similar to the one performed in "Business Cycle Accounting" (Chari, Kehoe and McGrattan (2005)) and identify what the authors term "wedges", which are, essentially, discrepancies in first order equations in the neoclassical growth model. If investment is too low, it may be due to sizeable wedges that distort investment decisions.

A partial answer can be found in the Indian labor laws. The neoclassical prediction is based on the assumption that a labor surplus would translate into low wage rates. This is not, however, the case: hiring a worker implicitly involves a dual cost, a wage rate and unemployment insurance—since termination is a costly transaction—and results in raising the effective wage rate. While this benefit accrues to a relatively small portion of the labor force, the potential distortions are significant.

Given the well articulated bargaining power of Indian labor unions, it is probably politically non-feasible or inexpedient to change these laws. One solution could be to "grandfather" the current workers and have new laws apply to new hires,[6] a solution that has, historically, met with less resistance from unions.

Miscellaneous Comments

Growth through Outsourcing

If the current growth rates in the service sector persist into the future, income from outsourcing, as a percentage of GDP, will be substantial over the next 10 to 15 years. This will make the Indian economy sensitive to the US and other countries' business cycle fluctuations. In fact, the Indian BPO will manifest an "amplified fluctuation" because of the lack of equivalent job placement in the domestic economy. A worker laid off in the outsourcing industry will experience a substantial drop in income since there are few, if any, jobs that are substitutes. This in turn would impact on consumer demand and through the multiplier effect could precipitate a recession. It may also affect the banking sector. Currently, local banks are making consumer loans with a 5 to 10 percent down payment. In the event of a severe

6. Another response to get around labor laws is domestic outsourcing. A senior Indian executive recently told me that his company, instead of starting an in-house IT department, decided to sub contract it. I am told the practice is becoming increasingly prevalent.

Yet another response is the lack of enforcement by some states in a bid to attract investment.

downturn, the possibility of a large-scale default could undermine, if not threaten, the stability of the banking system.

A time consistent solution would be to explicitly recognize this possibility and to tax a portion of service sector wages, with the proceeds being used to create a contingency fund, invested in assets whose performance is orthogonal to the economic well being of the US economy. This fund should be earmarked for partial unemployment insurance or as reserves, to bail out banks should the above scenarios occur.

Implications for Social Instability

The one billion plus Indian population can be roughly divided into three groups: the illiterate 400 million, the semi-literate 400 million and the 200 million with secondary and post secondary education.[7] The current trend in growth through services concentrates the vast majority of the gains in the hands of the 200 million. This is in contrast to the scenario in China where manufacturing plays a major part and the semi-literate also share in the gains.

In case of India, this pattern of growth is creating an increasing skewness in the wealth distribution with concomitant implications for social instability. As an example, witness the election results in several states with a flourishing service sector and the noticeable increase in Naxalite activity.

General Discussion

T. N. Srinivasan raised a number of questions related to data quality and estimation. First, contrary to the view taken by the authors, estimates of agricultural output are not that much better than those of outputs in other sectors. Second, the sample size of thin rounds of the NSS Employment Unemployment Surveys are sufficiently large for getting reliable estimates at the All-India level. In any case, there are serious problems in using NSS-based estimates of employment rates with census-based estimates of population to arrive at estimates of employment. (see Srinivasan, forthcoming). Therefore, the argument that only thick surveys can be used to get reliable estimates of employment, made by the authors, is not compelling. Third, one component of services is the government sector where output is measured by input. Any increase in the salaries of this component, say, following the recommendations of the Pay Commission, automatically translates

7. See table 8 in the paper.

into productivity increase. Fourth, there are serious problems with the way informal sector services and savings and investment are measured by the CSO. The methodology to measure them has not changed for decades. Finally, in estimating the rate of return on education, the authors do not take into account the selection bias. Who chooses to seek education and who does not is an endogenous decision and ignoring this would bias the estimate.

Abhijit Banerjee said we should not think of technology upgrading as in the traditional neo-classical model as the main source of TFP growth. In India, policy-imposed distortions lead to such vast differences between the values of marginal product of capital and labor (measured at world prices) across firms that equalizing them by itself can raise productivity by 2.5 times and eliminate the differences in productivity levels between India and the United States. One way to see this is to note that there are far too many medium size firms in India. These firms should either become very large or not exist at all. Distortions in the capital and labor market are the reason for the existence of so many medium size firms.

Banerjee raised two additional points. First, in line with what TN and Rajnish Mehra said, we do not know if the increase in the unit-value of services represented improved quality or price adjustment implicit in the methodology used to measure them that is unrelated to quality. Second, we need to understand why people do not want to move out of agriculture. Evidence shows that many who spend most of their time in agriculture do not actually earn most of their income from agriculture. They go out of their homes for less than 90 days and earn more income during that period than from agriculture the rest of the time.

Dilip Mookherjee joined the discussion on the measurement problems in services. He cited a careful survey that found the average monthly incomes of doctors in Delhi to be Rs 20,000. In comparison, the national income accounts use a figure of Rs 800 per month for the income of doctors. Similar problems must exist in other sectors such as transport and domestic services.

Focusing on the policy prescriptions in the paper, Aasha Kapur Mehta said that if poverty reduction is the objective, a lot more than what the paper prescribes needs to be done. Shankar Acharya referred to agriculture and its importance. Both farm and non-farm productivity must be raised. There is also the issue of people getting out of poverty and falling back into it.

Devesh Kapur made two points. First, the services aspect of manufacturing is being shifted to the unorganized sector and is now counted as services output. If you look at large manufacturing firms, prior to reforms,

things like transportation, security and canteen services were done within the firm. Since the reforms, there has been a trend towards shifting them out of the firm. This is true of not only the private sector, but the public sector as well. Class IV employees are being eliminated from public sector undertakings like BHEL. So, what is happening is that you see a smaller increase in the output of manufacturing because part of it is now being counted in the services.

Second, the issue of labor laws continues to surface in the discussions. But if you survey large firms on what constrains them, labor laws never figure among top five concerns, which typically include tax, corruption, a variety of micro regulations, and power supply. Most companies know how to deal with labor laws.

Kaushik Basu agreed with Devesh Kapur arguing that when firm managers are asked whether the labor law is binding and whether they are giving it top priority, they talk about a variety of other problems and labor laws do not figure in their replies. Perhaps, one of the reasons for that is that if one believes something to be inevitable, one does not mention it. The managers just take it as a given—something about which nothing can be done. Separately, Basu commented that Arvind Virmani put forward the point—a point widely made—that we need to emphasize the manufacturing sector. What is worrisome, however, is that we may be returning to the old Planning Commission view. The right thing to do is to remove all the stumbling blocks. There should be nothing, which is holding back the manufacturing sector. Labor laws are one of them. Corruption may be another. But you cannot have a target saying that really we want the manufacturing sector growth to be so much. That would throw us back to the old times.

Ajay Shah joined the discussion on labor laws offering an anecdote to make his point. He was once sitting face to face with a big Indian industrialist and asked him why he chose not to play in textiles even though he saw the end to the textile quotas coming? His answer was: the only way one could successfully play in the garment industry would be with 1,00,000 workers and that would not work with Indian labor laws. So, this businessman chose to go into other businesses like petroleum refineries in which he could work with a small number of contract workers.

Poonam Gupta commented on the point made by Devesh Kapur that growth in services may be grossly overstated on account of many manufacturing firms shifting services from within, to outside the firm. Based on her work, she found this outsourcing component to be very small. Much of the growth has come from other sectors that have been liberalized. And this growth is real and tangible.

Arvind Panagariya also joined the debate on labor laws. Taking cue from Ajay Shah's anecdote, he said those who we expect to say that labor laws are real hindrance to their operations are simply not there. These include large-scale manufacturers in the apparel or shoe industry. If you go and ask Infosys whether labor laws pose a threat to its operation, it is going to answer in the negative. Put differently, China produces and exports the unskilled-labor-intensive goods in large volumes. How is it that with very similar factor endowments, India does not do the same? Despite the abundance of unskilled labor, no one in India is willing to go into large-scale manufacturing of unskilled-labor-intensive products.

On a different issue, Panagariya said that one of the authors' premises behind the optimistic view on savings was questionable. The authors take the view that as we reduce the fiscal deficit, savings available to the private sector would expand one-for-one with the decline in the deficit. Whether or not this happens, is likely to depend on how you eliminate the deficit. If you are going to do this by increasing tax revenue, which seems to be everybody's favorite and perhaps the only feasible solution, it would almost surely cut disposable incomes and therefore private savings in significant volume. Indeed, even if you eliminate the deficit by cutting expenditure, private expenditure will rise at least partially (and correspondingly private savings would fall) to make up for the reduced supply of public goods.

Shankar Acharya joined the debate on labor laws expressing full agreement with Arvind Panagariya. Using a metaphor he attributed to Lant Pritchett et al. in their Development Policy Review of India, he said that in a desert one expects to see camels and not hippos. In other words, even if one has the factor endowment conducive to having labor-intensive industries (camels) but have crazy labor laws, you end up with capital and skilled-labor-intensive industries (hippos). Then if one asks hippos if humidity (crazy labor laws) bothers them, the answer will not be in the affirmative. That is the point Arvind Panagariya was making. If Reliance does not operate labor-intensive industries in the first place, no point asking them if crazy labor laws are a hindrance to their operations.

Turning to savings, Acharya said that a lot of the change is to be attributed to demographic change. That change is providing a lot of increase in the household savings. An extraordinary thing has been happening since '90s or thereabouts. In all households the number of dependents per household has dropped and the proportion of people in the working age population has risen. In a way this has rescued India from paying much larger cost of fiscal deficits.

Ashok Lahiri turned to the issue of productivity in manufacturing. Referring to the remark by Barry Bosworth that we do not expect high productivity growth in manufacturing because manufacturing activity consists of combining the machinery imported from abroad and domestic labor, he said that growth resulting from this process must show up mostly in TFP since the cost of imported machines is not especially high relative to the domestic machinery but it is more productive. For example, the difference in the cost of the second-hand textile machinery that we brought from Scandinavia in the last 10 years and that domestically available was minimal. But the productivity difference between the two sets of machines was enormous.

Lahiri also noted that whether savings prove a constraint on growth or not would depend on whether deficit declines or not. The reason is the low tolerance for the current account deficit. With the current account going into deficit after three years of surplus, concerns are already being expressed as if we are in a crisis.

The session concluded with brief responses by Arvind Virmani and Barry Bosworth. Virmani made four points. First, with respect to the measurement of services, modern services such as telecom and financial services and airlines services all of which are growing fast have reliable data. The real question is whether the remaining fast-growing services such as trade, hotel and restaurants have good data. Second, according to an event study, the change in the threshold from 300 to 100 workers for the application of chapter V B of the Industrial Disputes Act showed a significant drop in the number of firms with 100 to 300 workers. This is important evidence showing the labor law has stunted the growth of firms with more than 100 workers. Third, contrary to Kaushik Basu, manufacturing growth is not that important for GDP growth, but it is important for employment growth. Unless labor law changes, India will not have the transformation other countries have had and it will remain an outlier. Finally, if good policies are put in place and the economy is growing, savings will be forthcoming. Virmani agreed with the narrower point of Arvind Panagariya, however, that if the government has to tax to eliminate the fiscal deficit, the reduction in the deficit will have a negative impact on private savings.

Responding to Banerjee, Bosworth began by noting that the paper does take into account re-allocation effects. He also agreed that TFP is not a measure of technological change; indeed, technology innovation for developing countries is absurd. Differences in the level of TFP across enterprises are common and India is not especially different in this respect.

Much of TFP comes from inefficient firms exiting and efficient ones entering. There is no TFP growth within existing firms.

The other point Bosworth made concerned the selectivity bias issue that Srinivasan had raised. Virtually all studies have this selectivity bias. What this paper finds is that India is different in one important respect: non-linearity in the returns to education in that the return at the higher end of education jumps. This is consistent with the common observation that people in the middle of education distribution do not have very many job opportunities.

References

Acharya, Shankar, Isher Ahluwalia, K. L. Krishna, and Ila Patnaik. 2003. "India: Economic Growth, 1950–2000", *mimeo*, Indian Council for Research on International Economic Relations; abridged version in Parikh (2006).

Acharya, Shankar. 2002. "Macroeconomic Management in the Nineties", *Economic and Political Weekly*, April 20; reprinted in Acharya (2006).

———. 2003. *India's Economy: Some Issues and Answers*, Academic Foundation, New Delhi.

———. 2004. "India's Growth Prospects Revisited," *Economic and Political Weekly* (October 9).

———. 2006. *Essays on Macroeconomic Policy and Growth in India*, New Delhi: Oxford University Press.

Ahluwalia, Monteck. 2002. "Economic Reforms in India Since 1991: Has Gradualism Worked?" *Journal of Economic Perspectives*, 16(3): 67–88.

Baier, S. L., G. P. Dwyer Jr., and R. Tamura. 2006. "How Important are Capital and Total Factor Productivity for Economic Growth?" *Economic Inquiry*, 44(1): 23–49.

Banga, Rashmi, and Bishwananth Goldar. 2004. "Contribution of Services to Output Growth and Productivity In Indian Manufacturing: Pre and Post Reforms," working paper 139, ICRIER.

Banga, Rashmi. 2005. "Critical Issues in India's Service-Led Growth." Working paper no. 171, Indian Council for Research on International Economic Relations. (October)

Barro, Robert, and Jong-Wha Lee. 2000. "International Data on Educational Attainment, Updates and Implications." Working Paper 7911. Cambridge, MA: National Bureau of Economic Research (September).

Baumol, William J. 1967. "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crises," *American Economic Review,* 57(3), June: 415–26.

Bhalla and Das (2006)—see ftn 14.

Bhattarai, Madhusudan, and A. Narayanmoorthy. 2003. "Impact of Irrigation on Rural Poverty in India: An Aggregate Panel-data Analysis", Water Policy 5: 443–458.

Bosworth, Barry, and Susan M. Collins. 2003. "The Empirics of Growth: An Update," Brookings Papers on Economic Activity, 2003: 1.

Bosworth, Barry. 2005. "Economic Growth in Thailand: the Macroeconomic Context," paper prepared for world Bank project on the investment climate, firm competitiveness and growth in Thailand. Available at: http://www.brookings.edu/es/research/projects/develop/develop.htm

Buiter, Willem, and Urjit Patel. 1992. "Debt, Finances and Inflation: An Application to the Public Finances of India." *Journal of Public Economics* 47: 171–205.

Central Statistical Organisation. 1989. *National Accounts Statistics: Sources and Methods,* (New Delhi: Government of India).

Central Statistical Organisation. 1999. *New Series on National Accounts Statistics (Base Year 1993–94)*, (New Delhi: Government of India).

———. 2004. *Report of the Working Group on Workforce Estimation for Compilation of National Accounts Statistics with Base Year 1999–2000,* (New Delhi: Government of India)

———. 2005. *National Account Statistics, 2005*. (New Delhi: Government of India)

———. 2006. *New Series on National Accounts Statistics (Base Year 1999–2000)*, (New Delhi: Government of India).

Chari V.V., Patrick J. Kehoe, and Ellen R. McGrattan 2005. "Business Cycle Accounting." Federal Reserve Bank of Minneapolis Research Department Staff Report # 328.

Coelli, Tim J., and D. S. Prasada Rao. 2003. "Total Factor Productivity Growth in Agriculture: A Malmquist Index Analysis of 93 Countries," 1980–2000 Working Paper no. 02/2003, Centre for Efficiency and Productivity Analysis, School of Economics, The University of Queensland.

Dholakia, Bakul H. 2002. "Sources of India's Accelerated Growth and the Vision of Indian Economy in 2020." *The Indian Economic Journal*, 29(4): 27–46.

Directorate of Economics & Statistics. 2005. *Agricultural Statistics at a Glance, 2004*. New Delhi: Ministry of Agriculture. Available at: http://agricoop.nic.in/statatglance2004/AtGlance.pdf

Dollar, David, Giuseppe Iorossi, and Taye Mengistae. 2002. "Investment Climate and Economic performance: Some Firm level Evidence from India." World Bank Development Research Group, mimeo (May).

Duraisamy, P. 2000. "Changes in Returns to Education in India, 1983–94: By Gender, Age-Cohort and Location," Discussion paper no. 615, Economic Growth Center, Yale University.

Dutta, Puja Vasudeva. 2004. "The Structure of Wages in India, 1983–1999," PRUS Working Paper no 25, Poverty Research Unit of Sussex, University of Sussex.

Easterly, William, and Ross Levine. 2001. "It's Not Factor Accumulation: Stylized Facts and Growth Models." *World Bank Economic Review* 15(2): 177–219.

Easterly, William. 2001. *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics.* Cambridge, MA: MIT Press.

Evenson, Robert, Carl Pray, and Mark Rosegrant. 1999. *Agricultural Research and Productivity Growth in India*. (Washington D.C. International Food Policy Research Institute.

Foster, Andrew D., and Mark R. Rosenzweig. 2004. "Agricultural Productivity growth, Rural Economic Diversity and Economic reforms: India 1970–2000." *Economic Development and Cultural Change*. April; 52(3): 509–542.

Goldar, Bishwanath, and Arup Mitra. 2002. "Total Factor Productivity Growth in Indian Industry: a Review of Studies," in *National Income Accounts and Data Systems*, edited by B.S. Minhas. New Delhi: Oxford University Press: 218–37.

Goldar, Bishwanath. 2004. "Indian Manufacturing: Productivity Trends in Pre- and Post-Reform Periods," *Economic and Political Weekly* November 20: 5033–42.

Gordon, Jim, and Poonam Gupta. 2004. "Understanding India's Services Revolution." IMF Working paper WP/04/171 (September).

Hallward-Driemeier, Mary. 2005. "Improving the Climate for Investment and Business in South Asia." World Bank mimeo.

Hayashi, Fumio, and Edward C. Prescott 2006. "The Depressing Effect of Agricultural Institutions on the Prewar Japanese Economy." NBER working paper #12081.

Higgins, M., and J.G. Williamson, 1997, "Age Structure Dynamics in Asia and Dependence on Foreign Capital," *Population and Development Review*, 23(2): 261–293.

Hulten, Charles, and Sylaja Srinivasan. 1999. "Indian Manufacturing Industry: Elephant or Tiger? New Evidence on the Asian Miracle" NBER Working Paper No. 7441.

Hulten, Charles. 2001. "Total Factor Productivity: A Short Biography," in *New Developments in Productivity Analysis*, edited by Charles R. Hulten, Edwin R. Dean, and Michael J. Harper, Studies in Income and Wealth, vol. 63, (Chicago: The University of Chicago Press for the National Bureau of Economic Research, Chicago): 1–47.

Janaiah, Aldas, Lalith Achoth, and Cynthia Bantilan. 2005. "Has the Green Revolution Bypassed Coarse Cereal? The Indian Experience?" *eJADE*, Vol 2 (2005), Issue 1: 20–33.

Joshi, Vijay, and Ian M.D. Little. 2004. *India: Macroeconomics and Political Economy*. Washington DC: World Bank and Oxford University Press: New Delhi: Oxford University Press.

Kapur, Devesh, and Pratap Bhanu Mehta. 2004. "Indian Higher Education Reform: From Half-Baked Socialism to Half-Baked Capitalism," CID Working Paper No. 108 (Cambridge: Harvard University).

Klenow, Peter, and Andrés Rodriguez-Clare. 1997. "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?" In *National Bureau of Economic Research Macroeconomics Annual 1997*, edited by Ben S. Bernanke and Julio Rotemberg. Cambridge, MA: MIT Press.

Kochar, Anjini. 2002. "Emerging Challenges for Indian Education Policy." In *Economic Policy Reforms and the Indian Economy*, edited by Anne O. Krueger. Chicago: The University of Chicago Press.

Kohli, Atul. 2006. "Politics of Economic growth in India, 1980–2005—Part I: the 1980s." *Economic and Political Weekly*, April 1: 1251–1259.

———. 2006. "Politics of Economic growth in India, 1980–2005—Part II: the 1990s and Beyond." *Economic and Political Weekly*, April 8: 1361–1370.

Kolli. Ramesh, and S. Hazra. 2005. "Measuring Non-Observed Economy: Practices Followed In Indian National Accounts Statistics." No 5. Paper presented at 8th Meeting of Expert Group on Informal Sector Statistics (March), Nadi, Fiji Islands.

Kremer, Michael, Karthik Muralidharan, Nazmul Chaudhury, Jeffrey Hammer, and F. Halsey Rogers. 2005. "Teacher Absence in India." *Journal of the European Economic Association* 3 (2–3): 658–667.

Krueger, Anne. 2005. "Comment and Discussion," *Brookings Trade Forum* 2005 (2005) 232–238.

Lane, Philip, and Gian Maria Milesi-Ferretti. 2006. "The External Wealth of Nations mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004." IMF Working Paper WP/06/69 (March).

Loayza, Norman, and Rashmi Shankar. 2000. "Private Saving in India." *The World Bank Economic Review*. Vol. 14, No. 3 (September): 571–94.

Loayza, Norman, Klaus Schmidt-Hebbel, and Luis Serven. 2000. "What Drives Private Saving across the World?" *Review of Economics and Statistics*, Vol. 82 (August): 165–181.

Mishra, Deepak. 2006. "Can India Attain the East Asian Growth with South Asian Saving Rate?" World Bank mimeo (May).

Mühleisen, Martin. 1997, "Improving India's Saving Performance," IMF Working Paper No. 97/4 (IMF: Washington).

National Sample Survey Organization. 1997. *Employment and Unemployment Situation in India, 1993–1994*. NSS 50th Round, Report No. 409 (New Delhi: Government of India).

———. 2001. *Employment and Unemployment Situation in India, 1999–2000*. NSS 55th Round, Report No. 458 (New Delhi: Government of India).

———. 2005. *Employment and Unemployment Situation in India, January—June 2004,* NSS 60th Round, Report No. 506 (New Delhi: Government of India).

———. 2006. *Employment and Unemployment Situation in India, 2004–05,* NSS 61th Round, Report No. 515 (New Delhi: Government of India).

Organization for Economic Cooperation and Development (OECD). 2001. *Measuring Productivity: Measurement of Aggregate and Industry-level Productivity Growth.* OECD Manual, Paris. Available at: http://www.oecd.org/dataoecd/59/29/2352458.pdf

Panagariya, Arvind. 2004. "India in the 1980s and 1990s: A Triumph of Reforms," *Economic and Political Weekly*, 39(25): 2581–94.

———. 2005. "A Passage to Prosperity," *Far Eastern Economic Review* (July/August).

———. 2006. "Transforming India", *mimeo*, paper presented at Columbia University Conference "India: An Emerging Giant".

Parikh (ed.). 2006. *Explaining Growth in South Asia*, New Delhi: Oxford University Press.

Patrinos, Harry, Cris Ridao-Cano, and Chris Sakellariou. 2004. "Estimating the returns to education: Accounting for heterogeneity in ability." http://www.u-bourgogne.fr/colloque-iredu/posterscom/communications/PatrinosRidaoCanoSakellariou.pdf

Pritchett, Lant. 2001. "Where has all the Education Gone?" *World Bank Economic Review* 15(3): 367–391.

Psacharopoulos, George, and Harry Patrinos. 2004. "Returns to Investment in Education: A Further Update," *Education Economics*, 12(2), pp. 111–134, August.

Reddy, Y.V. 2005. "Importance of Productivity in India." Inaugural address given at the Annual Conference of the Indian Economic Association. http://rbidocs.rbi.org.in/rdocs/Speeches/PDFs/67936.pdf

Reserve Bank of India. 2006. Handbook of Statistics on the Indian Economy. Available at: http://www.rbi.org.in/scripts/Statistics.aspx.

Rodrik, Dani, and Arvind Subramanian. 2004b. "Why India Can Grow at 7 Percent a Year or More," *Economic and Political Weekly* (April 17).

———. 2005. "From "Hindu Growth" to Prod-uctivity Surge: The Mystery of the Indian Growth Transition," *IMF Staff Papers*, vol. 52, no. 2.

Rogers, Mark. 2003. "Directly Unproductive Schooling: How country characteristics affect the impact of schooling on growth." Oxford University Department of Economics Discussion Paper #166 (July). http://www.economics.ox.ac.uk/Research/wp/pdf/paper166.pdf

Saha, V., A. Kar, and T. Baskaran. 2004. "Contribution of Informal Sector and Informal Employment in Indian Economy." Paper presented at 7th Meeting of the Expert Group On Informal Sector Statistics New Delhi (February).

Shetty, S.L. 2006. "Revision of National Accounts Statistics: A Welcome Step, Good in Parts," *Economic and Policy Weekly* (June 10): 2317–26.

Sivasubramonian, Siva. 2004. *The Sources of Economic Growth in India, 1950–1 to 1999–2000*, New Delhi: Oxford University Press.

Solow, Robert. 1957. "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, 39(3): 312–20.

Srinivasan, T.N. 2003a. "The Indian Economy: Current Problems and Future Prospects," Stanford Center for International Development, Working Paper No. 173 (July).

———. 2003b. "Indian Economic Reforms: A Stocktaking," Stanford Center for International Development, Working Paper No. 190 (October).

———. 2005. "Information-Technology-Enabled Services and India's Growth Prospects," in *Brookings trade Forum 2005: Offshoring White-Collar Work*, edited by Susan M. Collins and Lael Brainard. Washington DC: The Brookings Institution.

———. Forthcoming. "Employment and Unemployment Since the Early Seventies," *India Development Report*, Indira Gandhi Institute of Development Research, Mumbai, India.

Srinivasan, T.N., and Suresh D. Tendulkar. 2003. *Reintegrating India with the World Economy* Washington D.C: Institute of International Economy.

———. 2005a. "Trends in Labour and Employment in India, 1983–2003," paper presented for the India LES of the World Bank.

———. 2005b. "Changing Structure of Indian Workforce, Quality of Employment, and Real Earnings, 1983–2000."mimeo, Delhi School of Economics, University of Delhi.

Triplett, Jack and Barry Bosworth. 2004. *Productivity in the U.S. Services Sector: New Sources of Economic Growth* Washington D.C: The Brookings Institution Press.

Virmani, Arvind. 1997. "India: Crises, Reform and Growth," *Economic and Political Weekly*, August 9, 1997.

———. 2004. "Sources of India's Economic Growth: Trends in Total Factor Productivity," Working paper no. 131, Indian Council for Research on International Economic Relations.

———. 2005. "Policy Regimes, Growth and Poverty in India: Lessons of Government Failure and Entrepreneurial Success," Working paper no. 170, Indian Council for Research on International Economic Relations.

Visaria, Pravin. 2002. "Workforce and Employment in India, 1961–94," *National Income Accounts and Data Systems*, edited by B.S. Minhas. New Delhi: Oxford University Press.

Wallack, Jessica Seddon. 2003. "Structural Breaks in Indian Macroeconomic Data." *Economic and Political Weekly*, October 11: 4312–4315.

World Bank. 2002. *India's Transport sector: The Challenges Ahead, Volume 1*. Washington DC: The World Bank. (May).

———. 2004. *India: Investment Climate and Manufacturing Industry*. Washington DC: The World bank (November).

Wu, Bing Kin, Venita Kaul and Deepa Sankar. 2005. "The Quiet Revolution: How India is achieving universal elementary education," *Finance and Development* 42: 2 (June).

Young, Alwyn. 1995. "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience," *Quarterly Journal of Economics* 100: 641–80.