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India's Economic Growth: Accumulation or Productivity

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Abstract

The present paper is an attempt to understand the sources of Indian growth experience for the period 1980-2004 using a newly developed INDIA KLEMS database. In particular, it examines the relative contributions of factor accumulation and productivity growth in all the sectors of Indian economy. A sector perspective gains significance in the context of major reforms in economic policies witnessed across all the major sectors in the past two decades. In addition, there has been significant structural transformation in the economy during the past decade suggesting a high and increasing share of service sector GDP. We use a growth accounting framework to document and analyze the sources of India's economic growth by industry. Following the KLEMS methodology due to Jorgenson *et.al* (1987), productivity performance of each of the industrial sectors is computed for the period 1980-2004 and the sub periods. The TFP growth incorporates contributions of labor-quantity and quality and capital-ICT and non ICT assets in its measurements. The paper documents the evidence of service sector led productivity growth in the Indian economy. We also find overwhelming evidence of factor accumulation in accounting for the sources of growth for the Indian economy and its various sectors as well as industries.

Key words: *Total Factor Productivity Growth, Factor Accumulation, Labor Quality, Capital Services.*
JEL classification: F43, O1, O4

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India's Economic Growth: Accumulation or Productivity

1. Introduction

Asian economic growth in the context of the so-called East Asian miracle in the 1970s and 1980s has been widely debated in the literature.1 The debate was mostly about the relative roles of factor accumulation and productivity growth. Economists now pay much attention to the recent awakening of Asia's two dormant giants, India and China, particularly in the 1990s. However, the growth experience of India has been different from many other economies of East Asia as well as Southeast Asia.[2]

Since the advent of gradual economic liberalization from the 1980s and the overhauling of the license raj regime in the 1991-92, Indian economy has been on a higher growth trajectory. India's annual growth rate accelerated from a moderate rate of 3.5 percent till 1980s to over 7 percent per annum by 2005. The upward growth path has been accompanied by extensive reforms in trade as well as industrial policies and supplemented by widespread changes in rules and regulations governing the financial sector. The emphasis on gradualism and evolutionary transition rather than rapid restructuring (Ahluwalia, 1994) as the underlying feature of India's economic reforms and consequent growth momentum has led to large number of research engagements with Indian economy both in India and abroad trying to analyze the underlying growth trends brought about by economic policy reforms.[3]

The literature on what are the sources of economic growth in India in the post independence era has been investigated extensively.4 Recent attempts at examining the aggregate growth performance confirm the positive role of productivity in enhancing economic growth particularly in the reform periods [Sivasubramonian (2001), Dholakia (2002), Guha and Bari (2003), Virmani (2004), Bosworth Collins and Virmani (2006)]. The aggregate growth performance has been generally supported by individual sectors of the Indian economy5. Nevertheless, two issues have emerged - one, the inability of the manufacturing sector to contribute substantially to the overall growth and the service sector led growth momentum to the overall growth in the 1990s [Kumar and Sengupta (2008); Gupta and Eichengreen (2009)]. The large number of documented evidence on India's growth performance stress by and large the twin roles of, "pro market reforms" of 1980s as well as "widespread economy-wide reforms" of 1990s and 2000s is sustaining the growth rate[6].

The objective of this paper is to examine India's long term growth experience by industries and to understand the proximate sources of growth. The debate on "Growth and Reforms" especially the "pro-business versus pro-market" and its impact on long term growth is yet unsettled as the empirics of growth has been addressed using aggregate economy data. The

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[1] See Young (1992), Kim and Lau (1994) and Collins and Bosworth (1997) among others.

[2] Unlike much of East Asia, India has neither an achieved high growth rate nor undergone prolonged periods of stagnation or decline(Panagariya, 2008)

[3] Prominent studies include Williamson and Zagha (2002); Delong J (2003), Basu and Maertens(2007), Panagariya (2008); Kochar et al (2009)

[4] Krishna (2007) gives an in-depth review of this literature by examining the methodologies and the evidences.

[5] There are studies drawing upon sectoral perspectives, in particular the sub-sectors of manufacturing, finding evidence on factor accumulation rather than productivity growth in accounting for output growth (Das, 2004).

[6] Though the debate on factors underlying the observed growth in India is far from settled, see Rodrik and Subramaniam, (2005), Panagariya (2008), Srinivasan and Tendulkar (2003), Kohli, (2006 a and b)for an assessment on the implications of reforms.

transition to a higher sustainable growth path, calls for an assessment of the channels through which policy reforms can sustain high growth path by observing the economy at detailed sectoral level. The present study specifically addresses this issue by examining the growth performance of the 31 industrial sectors of the Indian economy for the period 1980-2004 subdivided into four-sub periods-1980-85, 1986-90, 1992-96 and 1997-2004. These sub periods reflect policy orientation of the Indian economy during the decades of 1980s and 1990s. [7]In particular, the study attempts to quantify the sources of India's economic growth using newly constructed India KLEMS dataset[8] for individual industries. The industry level data enables us to identify the sources of India's economic growth to its industry origins. Further, given the growing optimism about India's long term growth prospects since the advent of an open economy regime, the paper seeks to examine whether productivity growth[9] or factor accumulation drives the observed growth performance of Indian economy by computing industry level total factor productivity growth and factor contributions.

The paper makes important contribution to the literature on the empirics of India's economic growth. First, it provides the most comprehensive and detailed sectoral analysis comprising the entire Indian economy. Second, the measures of labor and capital inputs incorporate the heterogeneity of different types of employees and capital assets. Finally an attempt is made to distinguish between organized and unorganized manufacturing sectors in accounting for productivity growth performances. The paper is divided into the following sections- Section II provides an overview of the methodology of the study. The database for the variables used to calculate the productivity indexes and growth rates are discussed in section III. The empirical assessments of the sources of growth are provided in section IV and the final section concludes the study.

2. An Outline of the Methodology

The section below addresses the methodology undertaken for measuring industry productivity growth.

Accounting for India's Economic Growth: The Growth Accounting Methodology

The organising principle underlying the KLEMS database is the growth accounting methodology. Growth accounting allows a decomposition of output growth into the growth of various inputs and productivity. This approach has a long history dating back to the seminal article by Jorgenson and Griliches (1967) and put in a more general input-output framework by Jorgenson, Gollop and Fraumeni (1987). It was further grounded in economic theory by Diewert (1976) and Caves, Christensen and Diewert (1982). It is based on production

[7] The study period has been categorized into four sub periods. The periods 1980-85 and 1986-90 represents piece meal deregulations and pro business/pro- market reforms, where as the periods 1992-96 and 1997-2004 represent the policy reforms of 1992-92 and consolidation of those reforms. The year 1991-92 has been excluded from our analysis on account of being a year of economic crisis.

[8] India KLEMS database is an ongoing project funded by the Reserve Bank of India. It aims to develop a complete sectoral database on output and inputs for 31 industrial sectors of the Indian economy, in close cooperation with the Central Statistical Organization.

[9] There is an extensive empirical literature on total factor productivity growth of the Indian economy at the level of manufacturing sectors (Ahluwalia (1991), Goldar (1986, 2002), Balakrishnan and Pushpangadan (1994) and Das (2004)). In addition, at the total economy level, fewer authors have looked at productivity performances (see for e.g. Brahmananda,1982; King and Levine, 1993; Guha and Bari, 2003; and Bosworth, Collins and Virmani, 2007).

possibility frontiers where industry output is a function of capital, labour and intermediary inputs and the level of technology T. Each industry, indexed by j, can produce a set of products and purchases a number of distinct intermediate, capital and labour inputs to produce its output. In the present paper, we use a value added function[10], where industry value added is a function of capital and labour inputs and the level of technology. Then, the production function is given by:

$$Y_j = f_j\left(K_j, L_j, T\right) \qquad (1)$$

where *Y* is value added, *K* is an index of capital service flows, *L* is an index of labour service flows, and *T* is the level of technology. All variables are also indexed by time, but the *t* subscript is suppressed wherever possible to facilitate exposition.

Under the assumptions of competitive factor markets, full input utilization and constant returns to scale and using the translog functional form common in such analyses, we can define total factor productivity (A^Y) growth as follows:

$$\Delta \ln A_j^Y \equiv \Delta \ln Y_j - \bar{v}_{K,j}^Y \Delta \ln K_j - \bar{v}_{L,j}^Y \Delta \ln L_j \qquad (2)$$

where $\Delta x = x_t - x_{t-1}$ denotes the change in the period from t-1 to t such that $\Delta \ln x$ indicates logarithmic growth rates, and $\bar{v}$ is the period average share of the input in nominal value added. With P^L, P^K and P^Y being respectively the prices of labour services, capital services and output, the value share of labour and capital inputs are defined as

$$v_{L,j}^Y = \frac{p_j^L L_j}{p_j^Y Y_j} \quad \text{and} \quad v_{K,j}^Y = \frac{p_j^K K_j}{p_j^Y Y_j} \qquad (3)$$

and the period average shares as:

$$\bar{v}_{L,j}^Y = 0.5 * (v_{L,j,t}^Y + v_{L,j,t-1}^Y) \text{ and } \bar{v}_{K,j}^Y = 0.5 * (v_{K,j,t}^Y + v_{K,j,t-1}^Y) \qquad (4)$$

As in (4), in the remainder of this paper we indicate the weight of a subcomponent (subscript) in its relevant aggregate (superscript) by using subscripts and superscripts on weights *v*. A bar on a variable always indicates period averages. Because of our assumption of constant returns to scale, labour and capitalinput shares add up to unity:

$$v_{L,j}^Y + v_{K,j}^Y = 1 \qquad (5)$$

This allows us to use observed output shares (such as wage share in value added) in the estimation of total factor productivity growth.

Rearranging equation (2) yields the standard growth accounting decomposition of value-added growth as the revenue-share weighted growth of inputs and the residual total factor productivity (TFP) growth:

[10] In the current version of India-KLEMS database, we use a value added function, rather than a gross output function. Since the India-KLEMS project aims to develop a complete set of inputs, including energy, materials and services, the analysis will be extended to a gross output function in the future.

$$\Delta \ln Y_j = \bar{v}^Y_{K,j} \Delta \ln K_j + \bar{v}^Y_{L,j} \Delta \ln L_j + \Delta \ln A^Y_j \qquad (6)$$

Each element on the right-hand side of (6) indicates the proportion of output growth accounted for by growth in capital services, labour services and TFP growth representing technical change. The latter cannot be directly measured and is derived as a residual as in (2).

Measuring Inputs and Output for growth accounting in Indian Economy

There have been many studies on productivity in India using the growth accounting methodology. Most these studies use measures of capital stock and number of employees as capital and labour inputs[11]. Such an approach would implicitly assume, for instance, that labour and capital is a homogenous input, so that different types of assets, such as computers and trucks, can be aggregated into one single aggregate capital stock. However, this is hardly the case. For instance, capital is a composite commodity consisting of different types of assets of different vintages, and therefore, they differ in their marginal productivities. Similarly, labour input consists of different skill and age levels, which also lead to corresponding difference in their productivities.

Therefore, it is important that measures of labour and capital inputs take account of the heterogeneity of the labor force and capital assets in measuring productivity and the contribution of these inputs to output growth. In the growth accounting literature, such measures are often called as labour services and capital services, as they allow for differences in the quantity of services delivered per unit of these inputs. Capital and labour input measures in the India KLEMS database follow this approach. We use capital services and labour services as inputs in our analysis.

In (6), we define the aggregate labour input L_j as a Törnqvist volume index of hours worked by individual labour types as follows:[12]

$$\Delta \ln L_j = \sum_l \bar{v}^L_{l,j} \Delta \ln H_{l,j} \qquad (7)$$

with weights given by

$$v^L_{l,j} = \frac{p^L_{l,j} H_{l,j}}{p^L_j L_j} \qquad (8)$$

where $\Delta \ln H_{l,j}$ indicates the growth of hours worked by labour type *l* and weights are given by the period average shares of each type in the value of labour compensation, such that the sum of shares over all labour types add to unity. As we assume that marginal revenues are

[11] See for instance, Goldar (1986 a and b), Ahluwalia (1991), Balakrishnan and Pushpangadan (1994), among others

[12] Aggregate input is unobservable and it is common to express it as a translog function of its individual components. Then the corresponding index is a Törnqvist volume index (see Jorgenson, Gollop and Fraumeni 1987). For all aggregation of quantities we use the Törnqvist quantity index, which is a discrete time approximation to a Divisia index. This aggregation approach uses annual moving weights based on averages of adjacent points in time. The advantage of the Tornqvist index is that it belongs to the preferred class of superlative indices (Diewert 1976). Moreover, it exactly replicates a translog model which is highly flexible, that is, a model where the aggregate is a linear and quadratic function of the components and time.

equal to marginal costs, the weighting procedure ensures that inputs which have a higher price also have a larger influence in the input index. So for example a doubling of hours worked by a high-skilled worker gets a bigger weight than a doubling of hours worked by a low-skilled worker.

In our analysis, the volume growth of labour input is split into the growth of hours worked and the changes in labour composition in terms of labour characteristics such as educational attainment, age and gender. Let H_j indicate total hours worked by all types $H_j = \sum_l H_{l,j}$ then we can decompose the change in labour input as follows:

$$\Delta \ln L_j = \sum_l \bar{v}_{l,j}^L \Delta \ln \frac{H_{l,j}}{H_j} + \Delta \ln H_j = \Delta \ln LC_j + \Delta \ln H_j \qquad (9)$$

The first term on the right-hand side indicates the change in labour composition[13] and the second term indicates the change in total hours worked.[14] It can easily be seen that if proportions of each labour type in the labour force change, this will have an impact on the growth of labour input beyond any change in total hours worked. Similarly,

Similarly, aggregate capital input K_j is defined as a Törnqvist volume index of individual capital assets as follows:

$$\Delta \ln K_j = \sum_k \bar{v}_{k,j}^K \Delta \ln K_{k,j} \qquad (10)$$

with weights given by

$$v_{k,j}^K = \frac{p_{k,j}^K K_{k,j}}{p_j^K K_j} \qquad (11)$$

where $\Delta \ln K_{k,j}$ indicates the volume growth of capital asset k and weights are given by the period average shares of each type in the value of capital compensation, such that the sum of shares over all capital types add to unity. Individual capital stocks are estimated using standard Perpetual Inventory Method (PIM) with geometric depreciation rates, and the rental price of capital $p_{k,j}^K$ are computed as

$$p_{k,t}^K = p_{k,t-1}^I i_t^* + \delta_k p_{k,t}^I$$

where p_k^I is the investment price of asset k, i^* is real external rate of return[15] δ_k is the assumed geometric depreciation rate of asset k.

[13] Note that this term is often called as "labor quality" in the growth accounting literature (see Jorgenson, Ho, and Stiroh, 2005). However, as indicated by van Ark et al (2008), this terminology might lead to confusion, as, for instance, a lower female wages would suggest that hours worked by females have a lower "quality" than hours worked by males. Therefore, they suggest using the term "labor composition." We may use these terms synonymously in the present paper.

[14] The first term is also known as "labour quality" in the growth accounting literature (see e.g. Jorgenson, Ho and Stiroh 2005). However, this terminology has a normative connotation which easily leads to confusion. For example, lower female wages would suggest that hours worked by females have a lower "quality" than hours worked by males. Instead we prefer to use the more positive concept of "labour composition".

[15] In the present version of the India-KLEMS database, we use an external rate of return. However, one can also use an internal rate of return, which will ensure complete consistency with NAS (see Jorgenson and Vu(2008)). This will be attempted in the future. See Erumban (2008) for a discussion on alternative approaches to the measurement of rental prices.

We distinguish between 4 types of capital assets; construction, ICT machinery, non-ICT machinery, transport equipment, and in the final calculations we provide the contributions of ICT capital and non-ICT capital separately.

Using the above formulas, we provide a full decomposition of growth in gross value added into the contributions of 1) labour composition (LC); 2) number of hours worked (H); 3) ICT equipments (ICT); 4) non-ICT capital (nICT); and 5) TFGP (A). Subsequently, equation (6) becomes

$$\begin{aligned}\Delta \ln Y_j = {} & \bar{v}^Y_{ICT,j}\Delta \ln K^{ICT}_j + \bar{v}^Y_{nICT,j}\Delta \ln K^{nICT}_j \\ & + \bar{v}^Y_{L,j}\Delta \ln LC_j + \bar{v}^Y_{L,j}\Delta \ln H_j + \Delta \ln A^Y_j\end{aligned} \qquad (12)$$

where the weights for capital inputs are given by the product of value added share of capital and asset share in total capital compensation, i.e. $\bar{v}^Y_{i,j} = \bar{v}^Y_{K,j}\bar{v}^K_{i,j}$, and therefore, $\sum_{i=1}^{n}\bar{v}^Y_{i,j} = \bar{v}^Y_{K,j}$

3. The Dataset

This section provides a description of the data, their sources, construction of variables and the industrial classifications used in the study. All the data used in the present study are taken from the preliminary version of the India-KLEMS database, which is constructed in close co-operation with the Central Statistical Organization (CSO). Hence the main sources of data are the various official publications of the CSO, supplemented by many unpublished source documents provided by the CSO for the India-KLEMS project. The published sources include National Accounts Statistics (NAS), Input-Output tables, Annual Survey of Industries (ASI) and various rounds of National Sample Survey Organizations (NSSO) surveys on employment & unemployment and unorganized sector. In addition, we also rely on other external sources such as the PROWESS database of the Centre for Monitoring Indian Economy (CMIE), UN-Comtrade trade database and WITSA digital planet report. In what follows we discuss these sources more specifically with regard to each of the variables used in our analysis. The period of analysis is 1980-2004.

In the KLEMS database, total economy is classified into 31 Industrial sectors, which includes the following broad sectors-(i) Agriculture, Hunting, Forestry and fishing, (ii)- 13 sectors belonging to industries including Manufacturing, Construction, Electricity, Gas and Water supply and (iii) 17 services sectors. In addition, we have compiled manufacturing sector in terms of unorganized as well as organized industries, given their importance to the Indian economy in terms of employment and value added. Issues regarding the aggregation and disaggregation of available official statistics into these 31 industrial sectors (see Table 1) are discussed in data appendix.[16] The advantage of the India-KLEMS industrial classification is that it ensures complete consistency with National Accounts Statistics and permits international comparison, as it follows the same approach as in the EU KLEMS.[17] Moreover, it provides a comprehensive as well as detailed coverage of the Indian economy.

[16] Also see Das and Erumban (2010) for a detailed discussion on the issues in the measurement of capital input for Indian economy and Aggarwal (2010) for labour input.

[17] See O'Mahony and Timmer (2009) for a description of EU KLEMS database. Also see www.euklems.net for the EU KLEMS data and many discussion papers.

Table 1: Indian Economy: 31 sectors India KLEMS industrial classification

India KLEMS INDUSTRIES	NIC 1998
Agriculture, hunting, forestry & fishing	01 to 05
Mining & quarrying	10 to 14
Food , beverages & tobacco	15 to 16
Textiles, leather & footwear	17 to 19
Wood & products of wood	20
Pulp, paper , printing & publishing	21 to 22
Coke, refined petroleum & nuclear fuel	23
Chemicals & chemical products	24
Rubber & plastics	25
Other non-metallic mineral	26
Basic metals & fabricated metal	27 to 28
Machinery, nec	29
Electrical & optical equipment	30 to 33
Transport equipment	34 to 35
Manufacturing nec; recycling	36
Electricity, gas & water supply	40 to 41
Construction	45
Sale & maintenance of motor vehicles; retail sale of fuel	50
Wholesale trade	51
Retail trade	52
Hotels & restaurants	55
Transport & storage	60 to 63
Post & telecommunications	64
Financial intermediation	65 to 67
Real estate activities	70
Renting of machinery & equipment	71 to 74
Public admin & defence	75
Education	80
Health & social work	85
Other community, social & personal services	90 to 93
Private households with employed persons	95

Source: India KLEMS database

The measure of output in the present paper is real gross value added, nominal value added deflated using sector specific GDP deflators. The value added figures for all sectors are taken from NAS, and whenever the relevant KLEMS sector data is not available we make use of information from ASI as well as NSSO to split industries.[18]

Labour input in the present paper is measured using total person hours worked. This has been arrived at by combining the number of employees obtained from Usual Principal and Subsidiary Status (UPSS) definition; with the intensity of work obtained from Current Daily Status (CDS), both from NSSO employment and unemployment surveys.[19] We use the five

[18] See appendix

[19] The *usual principal status* gives the number of persons who worked for a relatively longer part of the reference period of 365 days preceding the date of survey, while the *usual principal status* and the *subsidiary status*, includes the persons who (a) either worked for a relatively longer part of the 365 days preceding the date of survey or (b) who had worked some time during the reference period of 365 days preceding the date of

quinquinnal surveys starting from 38th round (1983) to 61st round (2004-05), and the data for the intermediate years are interpolated using linear interpolation. In equation (7), we also required composition of employment and labor compensation, in order to construction the labor quality index. NSSO employment and unemployment surveys also provide employment by sex, age and education for NIC industries. We exploit this information to construct the composition of employment in terms of 2 gender categories, 3 education categories (Up to Primary; Between Primary and Higher Secondary; and above Hr. Secondary) and 3 age groups (<29, 29-50, 50+). NSSO also provides information on compensation for these different employment categories. However, this information is available only for regular and casual workers. Therefore, we estimate the income of self-employed using a Heckman earning function, where the earnings have been regressed on the dummies of age, sex, education, location, marital status, social exclusion and industry. The corresponding earnings of the self-employed are obtained as the predicted value with similar traits.

Industry-level estimates of capital input require detailed asset-by-industry investment matrices. We obtained investment by broad industry groups by asset type from the National Accounts Statistics (NAS).[20] For those sectors for which the investment matrices were not available, we gather information from other sources (e.g. Annual Survey of Industries for organized manufacturing and NSSO surveys for unorganized manufacturing) and benchmark it to the aggregate investment series from the National Accounts. We consider 4 types of assets in our capital input computation – construction, transport equipment, non-ICT machinery, ICT equipments (hardware, software and communication equipment). From NAS and other sources we could construct investment series for three asset types, construction, transport equipment and machinery (including ICT). In order to calculate ICT investment series, we make use of all the available official information. For instance, ASI provides ICT investment data for organized manufacturing sectors for the period 1994-1999, NSSO 62nd round provides ICT investment for unorganized manufacturing sectors for 2005-06 and NAS provides software investment for the period after 2000. In addition, using commodity flow approach, we derive time-series of hardware and communication investment for the total economy. For this we use investment in ICT goods from input-output tables, and these are interpolated for intermediate years using domestic availability of ICT goods, computed using information on output of ICT goods from NAS and export and import of ICT goods from UN-Comtrade database. Since these sources are incomplete either in terms of time period or in terms of industry disaggregation, we supplement these sources with external sources. Additional information has been collected from various sources such as CMIE's Prowess firm level database and WITSA digital planet report. These sources have been used in combination with available information on ICT investment from official sources, in such a way that the final estimates are consistent with available official sources. A detailed discussion on ICT investment calculation is provided in data appendix. Combining these various sources, we obtained a complete series of nominal investment in all the 31 KLEMS sectors since 1950 (1973) for NAS sectors (for ASI sectors) for all the 4 asset types. CSO also provided as industry-asset specific investment deflators for non-ICT assets, which are used to derive real investment numbers. Deflators for ICT assets are derived using the harmonization procedure suggested by Schreyer (2002). We use the United States hedonics price deflators, adjusted for India's domestic inflation rates. As mentioned before, the real investment series are accumulated into stock estimates using the Perpetual Inventory Method (PIM) and the application of asset specific

survey. The *current weekly status* provides the number of persons worked for at least 1 hour on any day during the 7 days preceding the date of survey and the *current daily status* gives the average picture of the person-days worked in a day during the survey period. For a detailed description see Appendix 2.

[20] This data is not publicly available. However, CSO has compiled this data for the India-KLEMS project.

geometric depreciation rates. Since there is no estimates of depreciation rates available for Indian industries, we derive our depreciation rates for non-ICT assets according to the assumed lifetimes in NAS. These estimates are assumed to be equal across all industries. We assume 1.25% for construction, 5% for transport equipment and 4% for machinery (including ICT). For ICT assets we use take the rates from Jorgenson and Vu (2005), which are 31.5% for software and hardware and 11.5% for communication equipment. The rate of return (*i*) in equation (9) is computed as an external real rate of return, proxied by average of government securities and prime lending rate adjusted for CPI inflation rate. Finally, in order to employ the perpetual inventory method to calculate individual capital stock estimates, we require an initial benchmark capital stock. This has been taken from NAS's net capital stock estimates for the year 1950 for NAS sectors and for the year 1964 for ASI sectors.

4. Empirical Results

Structure and growth of broad sectors of the economy

In this section, we provide the empirical results of our growth decomposition exercise outlined in section 2. Table 2 shows the structure of the economy in terms of value added and employment shares of broad sectors of the economy for selected time points. Agriculture remains the largest employment provider for all periods of the study followed respectively by industry, and services suggesting the dominance of primary sector employment in the economy. In terms of value added share, we find the emergence of service sector as a leading contributor since the 1990s, an observation made by many previous studies (reference). The employment share of service sector, however, remains below that of agriculture by almost 50 percentage points throughout 1990s and 2000s. Despite gradual as well as complete overhauling of industrial and trade policies in the 1980s and 1990s, the share of manufacturing sector in total value added remains stagnant throughout the period.

Table 2: Structure of Indian Economy: Output and Value Added Share

	1980	**1990**	**2000**	**2004**
Agriculture				
Value Added Share	0.36	0.29	0.23	0.19
Employment Share	0.68	0.60	0.56	0.54
Industry				
Value Added Share	0.25	0.27	0.26	0.28
Employment Share	0.13	0.16	0.19	0.18
Manufacturing				
Value Added Share	0.17	0.17	0.16	0.16
Employment Share	0.11	0.11	0.13	0.12
Services				
Value Added Share	0.40	0.44	0.50	0.53
Employment Share	0.19	0.24	0.25	0.28

Source: India KLEMS database

Table 3 provides the growth rates of value added, labor and capital input for total economy and its broad subsectors namely- agriculture, industry, manufacturing and services for the period 1980-2004 and the sub periods covering the1980s as well as 1990s. The value added

growth rates have been by and large over 5 percent per annum for the total economy as well as for industry, manufacturing and services sectors. Agriculture has been an exception with around 3 percent growth rates for most of 1980s and 1990s. The second part of the 1990s through 2000s witnessed a decline in the value added growth rates in all the sectors except services. Services are the only sector which shows an improvement in the late 1990s and therefore may be attributed as the possible source of the improvement in the total economy growth rates. During the period 1980-2004, the growth rate in labor input, which is the product of hours worked and labor composition, is below 5 percent for most sectors including the total economy. An exception is service sector, where it has grown at the rate of almost 6 percent. In particular, agriculture sector shows a negligible growth in labor input for most of the time periods. Manufacturing and services show improvements in growth rate between the first and second half of both 1980s and 1990s. Capital services, on the other hand, shows steady improvement in growth rates throughout the period for the total economy as well as services sectors. It is around 2.5 per cent in agriculture sector for most of the time periods whereas for rest of the sectors the growth rate is over 5 percent per annum.

The observed growth patterns and structural changes lead to question which of the broad sectors is contributing to the observed overall growth of the economy. We have attempted to delineate the contribution of these sectors to aggregate growth, by weighting sectoral growth rates by their nominal value added shares. The results are provided in the panel B of table 3. As indicated before, we find evidence of service sector led growth for the entire period. The figures reveal that for much of the 1980s, service sector contributed almost 50 percent of the observed growth in the Indian economy with a sharp increase in its contribution in the late 1990s. Another feature that comes across from the above table is that despite extensive reforms in manufacturing, an acceleration of growth in manufacturing has been elusive with the resultant low contribution to aggregate value added by both manufacturing as well as industry.

Table 3: Growth of Output and Inputs and Sectoral Contribution to Growth: Broad Sectors

Panel A: Growth of Value Added, Labor and Capital inputs (per cent per annum)

	1980-85	**1986-90**	**1991-96**	**1997-04**	**1980-2004**
Economy					
Value Added Growth	5.08	5.92	6.49	5.69	5.78
Labour Input Growth	2.96	5.56	3.78	4.22	4.14
Capital Input Growth	4.31	5.27	6.11	6.77	5.77
Agriculture					
Value Added Growth	3.15	3.53	4.62	1.75	3.06
Labour Input Growth	0.63	1.19	1.46	0.84	1.00
Capital Input Growth	2.37	2.61	2.61	4.73	3.29
Industry					
Value Added Growth	5.78	7.31	7.31	5.57	6.37
Labour Input Growth	4.95	5.60	3.03	4.01	4.35
Capital Input Growth	7.62	7.91	8.54	7.30	7.77
Manufacturing					
Value Added Growth	6.33	7.03	9.07	4.71	6.52
Labour Input Growth	3.10	5.48	3.18	3.41	3.74
Capital Input Growth	7.07	7.93	10.06	6.39	7.67
Services					

Value Added Growth	6.15	6.71	7.06	7.51	6.94
Labour Input Growth	3.58	8.51	5.50	5.80	5.84
Capital Input Growth	3.81	5.46	6.75	7.35	6.04

Panel B: Sectoral Contribution of value Added growth

	1980-85	**1986-90**	**1992-96**	**1997-04**	**1980-04**
Agriculture	1.07	1.05	1.30	0.41	0.89
Industry	1.48	1.93	1.96	1.47	1.68
Manufacturing	1.05	1.16	1.52	0.72	1.06
Services	2.53	2.94	3.23	3.82	3.22

Note:
(1) All figures are average annual growth rates
(2) Capital and labor inputs are measured as labor services and capital services as explained in the text
Source: India KLEMS database

Sources of growth-the growth accounting results for broad sectors of the economy

In accounting for the overall growth for the Indian economy and its broad sectors, we provide a detailed break up of contributions of factor inputs namely labor- hours worked and labor composition and capital- non-ICT and ICT capital and total factor productivity growth. The analysis has been conducted for the period 1980-2004 and its sub periods. These sub periods reflect policy orientation of the Indian economy during the decades of 1980s and 1990s. The results are provided in Table 4. We observe that the relative contribution of TFPG to aggregate economic growth by and large has been low. For the period 1980-2004, the TFPG was below 2 percent for the total economy and it was even lower in the industry and manufacturing sub-sectors. Services are the only sector which exhibits close to 2 percent growth for the period whereas the agriculture sector performance replicates the total economy. If we look at the sub-periods, the TFPG in agriculture remains around 2 percent for the first 3 periods and then declines to a negative TFPG in the period 1997-2004. Manufacturing shows an improvement in the first half of 1990s as compared to the 1980s, and then shows a sharp decline in the late 1990s.[21] Same is seen in the industrial sector which includes besides manufacturing, mining, utilities and construction. In the service sector, we observe a TFPG of over 3 percent in the period 1980-85, followed by a lower growth in productivity for much of 1980s and 1990s. The observed low TFPG contribution may suggest the leading role of factor accumulation in accounting for the observed growth in India. We examine this further.

[21] The results of the manufacturing sector productivity performance are corroborated by several studies covering the period of 1991 reforms [Balakrishnan, et.al. (2000), Kumari (2001), Goldar and Kumari (2003) and Das (2004)]

Table 4: Sources of Value Added Growth: Broad Sectors

	1980-85	1986-90	1991-96	1997-04	1980-2004
Economy					
Value Added Growth	5.08	5.92	6.49	5.69	5.78
Hours Worked	1.52	2.66	1.47	1.62	1.79
Labour Quality	0.11	0.19	0.15	0.13	0.14
Non-ICT Capital	1.59	1.69	2.78	2.95	2.34
ICT Capital	0.14	0.27	0.33	0.23	0.24
TFPG	1.71	1.10	1.77	0.76	1.26
Agriculture					
Value Added Growth	3.15	3.53	4.62	1.75	3.06
Hours Worked	0.41	0.97	1.04	0.46	0.69
Labour Quality	0.14	0.11	0.10	0.11	0.11
Non-ICT Capital	0.30	0.21	0.68	1.70	0.85
ICT Capital	0.00	0.00	0.00	0.01	0.00
TFPG	2.30	2.24	2.80	-0.53	1.41
Industry					
Value Added Growth	5.78	7.31	7.31	5.57	6.37
Hours Worked	2.82	2.21	0.99	1.88	1.96
Labour Quality	-0.06	0.17	0.17	0.13	0.10
Non-ICT Capital	3.75	3.35	4.30	3.34	3.64
ICT Capital	0.55	1.01	0.93	0.26	0.63
TFPG	-1.28	0.57	0.92	-0.03	0.03
Manufacturing					
Value Added Growth	6.33	7.03	9.07	4.71	6.52
Hours Worked	1.05	1.41	0.56	1.01	1.01
Labour Quality	0.07	0.13	0.10	0.06	0.08
Non-ICT Capital	3.62	3.57	5.44	4.01	4.14
ICT Capital	0.84	1.61	1.45	0.41	0.99
TFPG	0.75	0.31	1.53	-0.77	0.29
Services					
Value Added Growth	6.15	6.71	7.06	7.51	6.94
Hours Worked	1.59	4.10	1.92	1.99	2.35
Labour Quality	0.20	0.24	0.17	0.15	0.18
Non-ICT Capital	1.28	1.69	3.13	3.25	2.46
ICT Capital	0.01	0.02	0.17	0.31	0.15
TFPG	3.08	0.66	1.68	1.82	1.81

Source: India KLEMS database

Table 4 also shows the relative contributions of labor and capital inputs to aggregate value added growth rates. We find the dominance of labor input in the 1980s and then the emergence of capital input as the leading contributor for much of the 1990s in accounting for

growth in the Indian economy. For the period 1980-2004, however we find the relative contribution of capital input being marginally better than labor input in driving the observed growth of value added. At the sectoral level, we find the dominance of non-ICT capital input as the single most important contributor to the overall growth throughout the period of study. This is particularly evident across all broad sectors of the Indian economy. Further, we do find evidence of improving contribution from ICT capital albeit very low in comparison to non-ICT capital where machinery and equipment including transport equipment constitute a bulk segment of the overall non-ICT capital. This is not surprising as the ICT share in total capital is very small, though we observe a distinct increase in ICT capital contribution in the service sector. However it is important to note that the contribution of ICT capital is positive and shows improvement over years, which is suggestive of the increasing role of ICT use in Indian economy. The contribution of labor input is captured both in terms of number of hours worked and composition of labor. The number of hours worked emerges as the dominant contributor across all sectors and periods. The improvement in labor quality giving rise to observed growth is by and large low across sectors. Even though the quantitative magnitude of this contribution is small, it is positive throughout. This suggests that the process of transformation of the Indian workforce to higher skill is continuing, or the share of high skilled workers in the labor force is increasing. The new comers in the labor market may have had on average more educational skills than the existing workforce. This is particularly evident in the service sector. Further in the industry, the data points towards an improvement in labor skills however no pattern is discernable in any of the sectors. The contributions of the labor input in terms of number of man hours indicates that the production capacity of the economy is enhanced by direct increase in the number of hours worked and along with other contributing inputs is reflected in the increasing value added growth.

Table 5: Sectoral contribution to Productivity Growth

	1980-85	1986-90	1992-96	1997-04	1980-04
Economy	1.71	1.10	1.77	0.76	1.26
Agriculture	0.78	0.67	0.78	-0.13	0.44
Industry	0.33	0.15	0.25	-0.01	0.01
Manufacturing	1.27	0.05	0.26	0.13	0.05
Services	1.27	0.29	0.74	0.90	0.81

Source: India KLEMS database

The table above provides evidence of sector's contribution to the productivity growth for the economy. If we look at the period of the study, we find evidence of service sector TFP growth driving the productivity growth in the economy. The second best contribution comes from agriculture. The period wise scenario however shows that a substantial part of the aggregate productivity growth generated through the agriculture sector. Two points are interesting- the service sector drives productivity growth even in the sub periods even though there is sharp decline in the second period followed by improved contribution in the 1990s. In the late 1990s, the service contribution is particularly striking when compared against the other sectors.[22] The contribution of manufacturing reflects the lack of dynamism in India's manufacturing Sector despite extensive reforms.

[22] Our evidence on service sector TFP growth performance corroborates the findings of Goldar and Mitra (2008), who has shown that faster TFP growth in services sector in the post 1980s period has been an important contributor to economic growth.

Finally our productivity estimates for total economy as well as broad sectors when juxtaposed against some prominent studies (Bosworth and Maertens, 2010 and Jorgenson and Vu, 2005) covering roughly the same period confirms the overwhelming role of factor accumulation in. accounting for India's economic growth. Table 6 reports our estimates along with estimates of the studies mentioned above.

Table 6: Productivity growth by sectors and economy: Comparison

TOTAL ECONOMY						
TFP	1980-90	1990-2000	2000-04*	TFP	1989-95	1995-03
Our study	1.4	0.9	0.6	Our study	1.4	0.81
Bosworth and Maertens	2.2	1.8	2.1	Jorgenson and Vu	2.06	2.49

	Agriculture			Industry			Services		
TFP	1980-90	1990-00	2000-04	1980-90	1990-2000	2000-04	1980-90	1990-2000	2000-04
Our study	2.3	0.2	-0.8	-0.4	-1.1	2.2	1.9	2.4	0.4
Bosworth and Maertens	1.9	0.7	0.9	1.5	0.6	1.6	2.1	3.1	1.9

Note: * Bosworth and Maertens period is from 2000-06
Source: Bosworth and Maertens (2010), Jorgenson and Vu (2005)

The table shows that our total economy TFP growth numbers are consistently declining as against an improvement albeit low seen in Jorgenson and Vu (2005) and in Bosworth and Maertens (2010) in the second half of the 1990s. Our sectoral TFPG estimates, however, show a comparable trend during 1980s and 1990s as in Bosworth and Maerterns, though there are differences in the magnitudes. Results for 2000s however show divergence; our results suggests a decline in TFPG in agriculture and services, while their results show a marginal increase in all sectors. Part of the observed differences might be attributed to the differences in underlying methodologies of the three studies, and also the coverage of sectors within each broad category. A common observation that emerges from the extensive empirical evidence that have focused on characterizing India's growth performance at the level of broad sectors including the present paper is the declining contribution of TFPG in agriculture and industry sectors and an increasing or stable TFPG in the services sectors during the 1990s.

The sectoral perspective

The examination of the growth empirics of the Indian economy in the previous section highlighted the principal role of factor accumulation in accounting for India's growth during 1980-2004. This was further evident at the broad sectoral level - agriculture, industry and services. Yet the presence of significant heterogeneity within these broad sectors and the fact that aggregate economic performances do not shed light on the sectoral dynamism, calls for an in depth analysis at the level of individual industries which comprise these broad sectors.

We have undertaken a growth accounting exercise for 31 India KLEMS industrial sectors which comprise the entire economy. Table 7 provides the contributions of the factor inputs as well as TFP growth in accounting for growth of the individual industries. As indicated elsewhere labor input has been divided between hours worked and labor quality. The

contributions of non-ICT and ICT assets have been complied in constructing the capital input. Productivity growth is the difference between rate of growth of value added and contributions of capital and labor inputs specified as above.

Table 1: Sources of Value Added Growth by Industries: 1980-2004

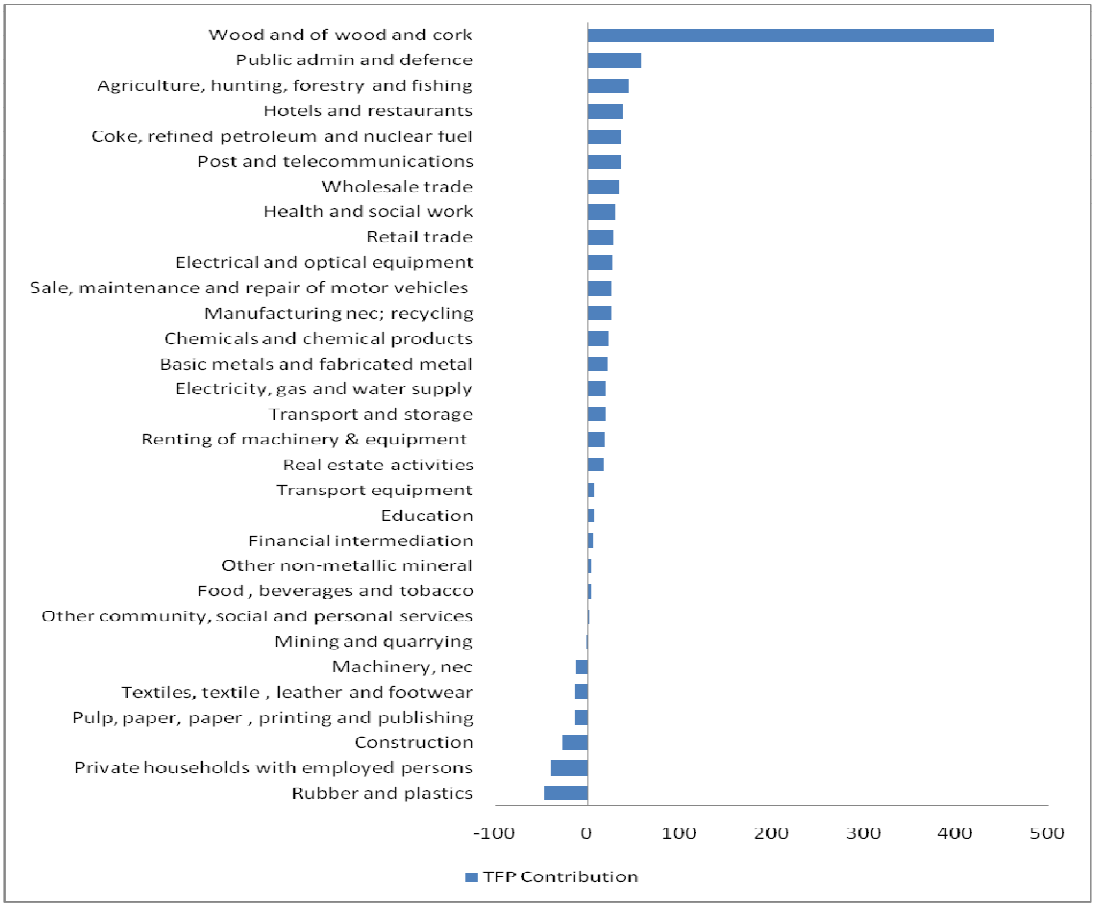
NIC Code	Industry	1980-85						1986-90					
		Value Added Growth	Hours Worked	Labour Quality	Non-ICT Capital	ICT Capital	TFPG	Value Added Growth	Hours Worked	Labour Quality	Non-ICT Capital	ICT Capital	TFPG
01 to 05	Agriculture, hunting, forestry & fishing	3.15	0.41	0.14	0.30	0.00	2.30	4.51	1.10	0.10	0.22	0.00	3.08
10 to 14	Mining & quarrying	6.67	1.95	0.05	9.27	0.01	-4.60	8.99	1.39	0.25	6.01	0.02	1.32
15 to 16	Food , beverages & tobacco	7.02	0.52	-0.01	9.16	0.15	-2.80	6.37	0.96	0.06	4.12	0.60	0.64
17 to 19	Textiles, leather & footwear	3.27	0.98	0.07	1.16	1.29	-0.23	4.64	0.31	0.07	1.65	3.25	-0.64
20	Wood & products of wood	-1.60	0.48	0.07	5.94	0.13	-8.22	-3.56	-0.87	-0.10	5.65	0.29	-8.54
21 to 22	Pulp, paper , printing & publishing	6.11	2.44	0.06	3.55	1.06	-1.01	7.53	1.16	0.18	3.55	1.12	1.52
23	Coke, refined petroleum & nuclear fuel	15.49	2.06	-0.08	-1.09	1.44	13.16	11.61	1.26	0.06	1.59	2.02	6.69
24	Chemicals & chemical products	9.58	0.63	0.28	2.77	0.00	5.90	11.78	1.51	0.12	7.18	1.07	1.90
25	Rubber & plastics	8.36	2.17	0.23	5.79	0.00	0.17	9.36	3.32	0.13	7.66	0.54	-2.28
26	Other non-metallic mineral	9.30	0.90	-0.03	8.57	0.00	-0.15	9.76	0.48	0.10	3.54	0.10	5.53
27 to 28	Basic metals & fabricated metal	4.13	1.23	0.08	2.04	0.00	0.78	9.89	1.11	0.03	3.85	1.87	3.03
29	Machinery, nec	7.49	-0.71	-0.07	2.47	1.64	4.17	4.33	5.90	0.38	3.58	1.42	-6.95
30 to 33	Electrical & optical equipment	8.63	1.83	0.09	2.98	2.74	0.98	8.24	2.37	0.33	1.73	2.90	0.91
34 to 35	Transport equipment	6.11	2.47	0.03	-0.76	2.50	1.87	4.88	0.47	0.51	2.11	1.71	0.08
36	Manufacturing nec; recycling	21.88	2.49	-0.03	5.84	0.05	13.53	3.02	1.69	0.14	4.94	0.54	-4.29
40 to 41	Electricity, gas & water supply	8.01	1.87	0.29	4.27	0.01	1.57	8.12	3.22	0.14	4.14	0.08	0.54
45	Construction	2.44	10.17	-0.72	0.69	0.00	-7.70	7.58	3.46	0.54	0.67	0.00	2.90
50	Sale & maintenance of motor vehicles & motorcycles; retail sale of fuel	5.77	1.26	-0.19	1.81	0.00	2.89	5.70	4.52	0.08	2.76	0.00	-1.66
51	Wholesale trade	5.77	1.04	0.00	1.94	0.00	2.79	5.70	2.52	0.06	3.10	0.00	0.02
52	Retail trade	5.77	2.55	0.11	0.94	0.01	2.16	5.70	5.42	0.21	0.47	0.05	-0.44
55	Hotels & restaurants	5.03	1.91	0.00	2.66	0.05	0.42	7.84	3.55	0.17	0.88	0.16	3.08
60 to 63	Transport & storage	5.73	1.93	0.06	0.96	0.00	2.78	5.40	4.30	0.14	1.72	0.00	-0.76
64	Post & telecommunications	5.45	-0.41	0.51	2.91	0.11	2.32	6.25	4.27	0.18	5.10	0.32	-3.61
65 to 67	Financial intermediation	9.82	2.31	0.44	3.66	0.00	3.42	9.73	5.56	0.49	5.67	0.00	-1.99
70	Real estate activities	7.39	0.26	0.12	0.71	0.00	6.30	8.10	1.97	0.22	2.01	0.00	3.91
71 to 74	Renting of machinery & equipment	12.00	2.54	-0.02	1.82	0.00	7.66	6.40	5.19	0.05	3.10	0.00	-1.94
75	Public admin & defence	6.08	2.85	0.47	0.85	0.00	1.91	5.95	3.78	0.52	0.72	0.00	0.93
80	Education	5.99	0.62	0.34	1.82	0.00	3.20	7.82	6.26	0.21	2.48	0.01	-1.14
85	Health & social work	7.22	0.88	0.37	0.60	0.00	5.37	9.26	4.89	0.50	0.35	0.00	3.51
90 to 93	Other community, social & personal services	2.12	1.12	0.20	0.35	0.01	0.44	4.07	10.79	0.21	0.08	0.00	-7.01
95	Private households with employed persons	0.89	-0.23	-0.29	0.97	0.00	0.44	1.38	1.67	-0.84	1.17	0.00	-0.62

NIC Code	Industry	1992-96 Value Added Growth	Hours Worked	Labour Quality	Non-ICT Capital	ICT Capital	TFPG	1997-04 Value Added Growth	Hours Worked	Labour Quality	Non-ICT Capital	ICT Capital	TFPG
01 to 05	Agriculture, hunting, forestry & fishing	4.62	1.04	0.10	0.68	0.00	2.80	1.75	0.46	0.11	1.70	0.01	-0.53
10 to 14	Mining & quarrying	3.49	-0.14	0.09	3.80	0.02	-0.29	4.84	0.55	0.35	1.85	0.05	2.05
15 to 16	Food , beverages & tobacco	6.80	0.86	0.08	3.80	0.25	1.82	5.20	0.27	0.09	3.12	0.08	1.65
17 to 19	Textiles, leather & footwear	9.05	-0.98	0.11	6.89	0.59	2.44	3.58	2.67	0.06	3.64	0.10	-2.89
20	Wood & products of wood	5.56	0.41	0.00	3.54	3.40	-1.78	-6.52	1.34	0.04	7.41	0.94	-16.25
21 to 22	Pulp, paper , printing & publishing	3.66	1.21	0.14	3.22	0.23	-1.14	3.53	1.88	0.21	3.49	0.57	-2.62
23	Coke, refined petroleum & nuclear fuel	15.66	0.59	0.13	5.25	2.94	6.74	4.92	-0.19	-0.02	11.13	-0.08	-5.93
24	Chemicals & chemical products	12.10	0.60	0.04	6.23	2.89	2.34	6.82	0.46	0.02	5.27	0.41	0.65
25	Rubber & plastics	6.15	2.74	0.09	11.11	1.42	-9.21	-0.13	0.07	0.09	3.28	0.10	-3.68
26	Other non-metallic mineral	8.82	0.44	0.11	6.16	0.59	1.53	3.63	1.29	0.01	4.60	0.15	-2.41
27 to 28	Basic metals & fabricated metal	8.31	0.99	0.06	4.12	2.63	0.51	4.84	0.77	0.06	1.18	0.47	2.36
29	Machinery, nec	10.18	0.80	0.22	4.12	1.53	3.51	2.66	0.09	0.17	3.99	1.06	-2.64
30 to 33	Electrical & optical equipment	8.55	1.89	0.13	4.62	0.72	1.19	8.07	0.64	0.00	4.18	0.54	2.71
34 to 35	Transport equipment	12.10	-0.75	0.16	7.78	0.55	4.36	5.65	2.57	0.06	5.29	1.20	-3.47
36	Manufacturing nec; recycling	13.12	0.47	0.17	4.76	1.86	5.86	9.68	1.73	0.08	5.69	0.62	1.55
40 to 41	Electricity, gas & water supply	6.96	0.22	0.16	3.65	0.30	2.63	5.04	0.44	0.29	3.49	-0.07	0.89
45	Construction	3.38	3.52	0.41	0.99	0.04	-1.58	8.50	5.43	0.14	2.06	0.06	0.81
50	Sale & maintenance of motor vehicles & motorcycles; retail sale of fuel	8.67	1.98	0.05	3.10	0.05	3.50	8.75	1.63	0.21	4.35	0.27	2.29
51	Wholesale trade	8.67	0.44	0.10	3.41	0.01	4.70	8.83	1.22	0.02	5.13	0.07	2.39
52	Retail trade	8.67	2.22	0.16	1.48	0.63	4.19	6.46	1.87	0.15	3.01	-0.12	1.55
55	Hotels & restaurants	10.58	2.09	0.17	2.84	-0.30	5.78	8.63	3.11	0.10	2.07	0.20	3.16
60 to 63	Transport & storage	6.55	2.77	0.16	2.22	0.01	1.39	7.15	2.60	0.13	2.88	0.40	1.14
64	Post & telecommunications	13.18	2.70	0.03	7.43	0.31	2.71	21.11	3.43	0.06	5.09	0.82	11.72
65 to 67	Financial intermediation	7.91	1.45	0.18	11.85	0.40	-5.97	8.06	1.92	0.03	2.09	0.69	3.34
70	Real estate activities	4.84	0.58	0.20	2.21	0.06	1.78	2.61	3.38	0.20	3.62	0.43	-5.02
71 to 74	Renting of machinery & equipment	12.16	5.10	0.08	5.08	0.19	1.72	18.40	4.22	0.17	10.66	1.46	1.89
75	Public admin & defence	3.84	0.86	0.28	0.70	0.00	2.01	6.41	-0.94	0.28	0.49	0.16	6.42
80	Education	6.76	3.18	0.14	2.89	0.03	0.52	8.04	3.69	0.03	4.65	0.42	-0.74
85	Health & social work	6.86	3.43	0.24	2.03	0.00	1.16	9.59	3.79	0.27	4.55	0.05	0.93
90 to 93	Other community, social & personal services	7.24	4.42	0.07	0.54	0.00	2.21	2.99	-0.11	0.36	1.11	0.03	1.60
95	Private households with employed persons	-0.21	-1.03	0.04	1.27	0.00	-0.47	6.59	5.70	0.05	3.66	0.02	-2.83

Source: India KLEMS database

There are wide variations in TFP growth across time periods as well as industries. There is no definitive pattern across industries as we observe the presence of both industries showing improvements as well as decline in TFP growth. The agriculture sector shows modest TFP growth performance in the period with improvements in the second half of 1980s, followed by a decline in the second half of 1990s. An in-depth assessment of the TFP performance shows a large number of industries recording decline in TFP when we compare first and second half of the 1980s and 1990s though the extent of declines are less in the 1990s as compared to 1980s. However comparisons of the mid 1980s with the early 1990s show a distinct improvement in majority of industries thereby perhaps indicating the impact of a gradual liberalization of the industrial and trade policies on sectoral productivity.[23] Within the industrial sector of the economy, we find improvements in TFP for 6 sectors each in the 1980s and in the 1990s. In the case of services, most of the sectors show TFP growth rates in excess of 2 percent in the period 1980-85 and consolidate their productivity performance by the end of 1990s.

FIG 1: Contribution of sectoral TFP growth to aggregate TFP growth: 1980-2004 (per cent)



Note: Industries are ordered in ascending order of TFP contribution
Source: India KLEMS database

[23] Ahluwalia (2002) reviews the policy changes in several major areas covered by economic reforms program especially trade and industrial policy to assess if the cumulative outcomes of gradualist approach have created an environment which can support a 8 percent GDP growth for India.

Regarding the relative contribution of factor inputs compared to TFPG, we find that factor accumulation is driving output growth in most sectors. The relative contribution of TFP growth is small and declining through the different sub periods. Only in the first half of the 1980s we witness productivity growth driving the overall growth in a large number of industries such as Coke, Chemicals and Machinery to name a few. Agriculture is the only sector where productivity growth drives output growth for all the four sub periods. For both industry and services, we find significant productivity growth contribution in a large number of industries for the beginning of the 1980s, however this declines to all most none in the 1990s.

Using our methodology, we can also decipher the significance of various factor inputs by looking into contributions of labor hours, labor composition, non-ICT and ICT capital. At the outset it is evident that the single significant contributing input is the non-ICT capital input to the growth in most of the individual industries in almost all sub periods from 1980 till2004. ICT capital makes important contribution in some industries particularly electrical machinery & equipment, transport equipment, textiles, wood, coke etc, particularly in the 1990s. The pattern is different when we consider the individual sectors of services, where we find the predominance of labor hours worked in accounting for growth in the 1980s. In the 1990s however even in the service industries, we find relative contribution of non-ICT capital dominating. Thus the table indicates the larger role of non-ICT capital in driving output growth in the services sector, with the labor input worked occupying a second lead. Both labor quality as well as ICT capital, though do not show high contribution in terms of quantitative magnitude, always suggest a positive and mostly increasing contribution, suggesting the increasing importance of these inputs to growth.

Manufacturing productivity performance: Organized and Unorganized industries

Our examination of both broad aggregates as well as individual sectors point towards the role of factor accumulation in accounting for growth in India, both at the aggregate and in most disaggregate industrial sectors. An important observation is the low productivity growth in the industrial sector especially in the manufacturing sector. Therefore, it may be interesting to examine this sector further, given that the manufacturing sector in India is crucial for providing employment to an expanding labor force as well as in stimulating growth in other areas of the economy. Further, reforms in mid 1980s as well as 1991 were specifically targeted to improve the competitiveness and productivity in this sector. A detailed look at the manufacturing sub-sectors suggest that in certain sectors of manufacturing namely - wood and wood products, coke, refined petroleum, chemical and chemical products and machinery TFPG in the early 1980s has been impressive. However, the TFPG performance has tapered off in the late 1980s and was further declined in the 1990s. Raising and sustaining productivity growth in individual sectors is imperative for raising manufacturing growth in a sustained basis. Further, given that unorganized manufacturing has a significant share in both employment and value added, it becomes imperative to examine the productivity performance by looking at the organized and unorganized segments of manufacturing in India separately[24].

[24] Though there is a large body of literature examining the productivity growth in manufacturing, most these studies consider only the organized segment. There is a dearth of comprehensive examination of the productivity performance in the unorganized manufacturing (Unni *et al*, 2001; Mukerjee, 2004; Kathuria *et al*, 2010).

Table 8: TFP Growth in Manufacturing: Organized and Unorganized industries (per cent per annum)

		1980 - 1985		1986 -1990		1992 - 1996		1997 - 2004		1980 - 2004	
NIC Code	**Industry**	ORG	UNORG	ORG	UNORG	ORG	UNORG	ORG	UNORG	ORG	UNORG
15 to 16	Food , beverages & tobacco	0.19	-6.18	2.30	-3.29	4.05	6.44	2.73	0.49	2.37	-1.73
17 to 19	Textiles, leather & footwear	3.52	-15.00	2.99	-4.49	-0.20	1.30	-0.98	-3.37	1.03	-4.47
20	Wood & products of wood	4.38	-10.28	7.86	-10.65	-12.40	-10.09	-14.88	-14.11	-5.21	-9.60
21 to 22	Pulp, paper , printing & publishing	2.65	-1.54	6.68	-0.75	-4.93	-3.59	-3.03	1.21	-0.10	1.12
23	Coke, refined petroleum & nuclear fuel	14.06	-1.53	12.11	-26.33	8.22	-13.08	-6.71	14.30	5.14	-1.50
24	Chemicals & chemical products	6.70	-1.21	1.98	0.30	2.93	-1.66	0.55	0.98	2.71	0.03
25	Rubber & plastics	-0.27	-0.45	11.02	-4.77	-8.14	2.31	-8.66	1.80	-2.44	-2.55
26	Other non-metallic mineral	2.85	-5.30	6.54	-0.68	4.26	3.48	-0.27	-6.05	2.88	-5.33
27 to 28	Basic metals & fabricated metal	3.85	-5.69	2.21	-0.17	1.61	4.60	3.26	1.42	2.80	-0.45
29	Machinery, nec	4.29	-0.57	-1.65	-9.20	7.45	1.50	-2.80	0.73	1.22	-2.43
30 to 33	Electrical & optical equipment	1.74	-5.18	3.28	10.93	6.14	4.87	4.55	-0.96	4.01	-0.88
34 to 35	Transport equipment	4.66	-41.77	3.94	-3.41	5.29	3.77	-1.16	-8.41	2.62	-13.12
36	Manufacturing nec; recycling	27.12	6.65	-13.09	-1.65	9.34	10.52	1.24	0.39	5.51	1.91

Note: 1.All figures are average annual growth rates

2. The TFP computations are done for the registered and unregistered manufacturing sectors using labor employment and capital stock.

3. ORG and UNORG stands for organized and unorganized manufacturing industries

Source: India KLEMS database

We examine the relative productivity performance of individual sectors in the organized and unorganized manufacturing for the period 1980-2004 and the sub-periods. However, this analysis has been made using measures of capital stock and employment, as we are yet to develop capital services and labor services for the organized and unorganized sectors separately.

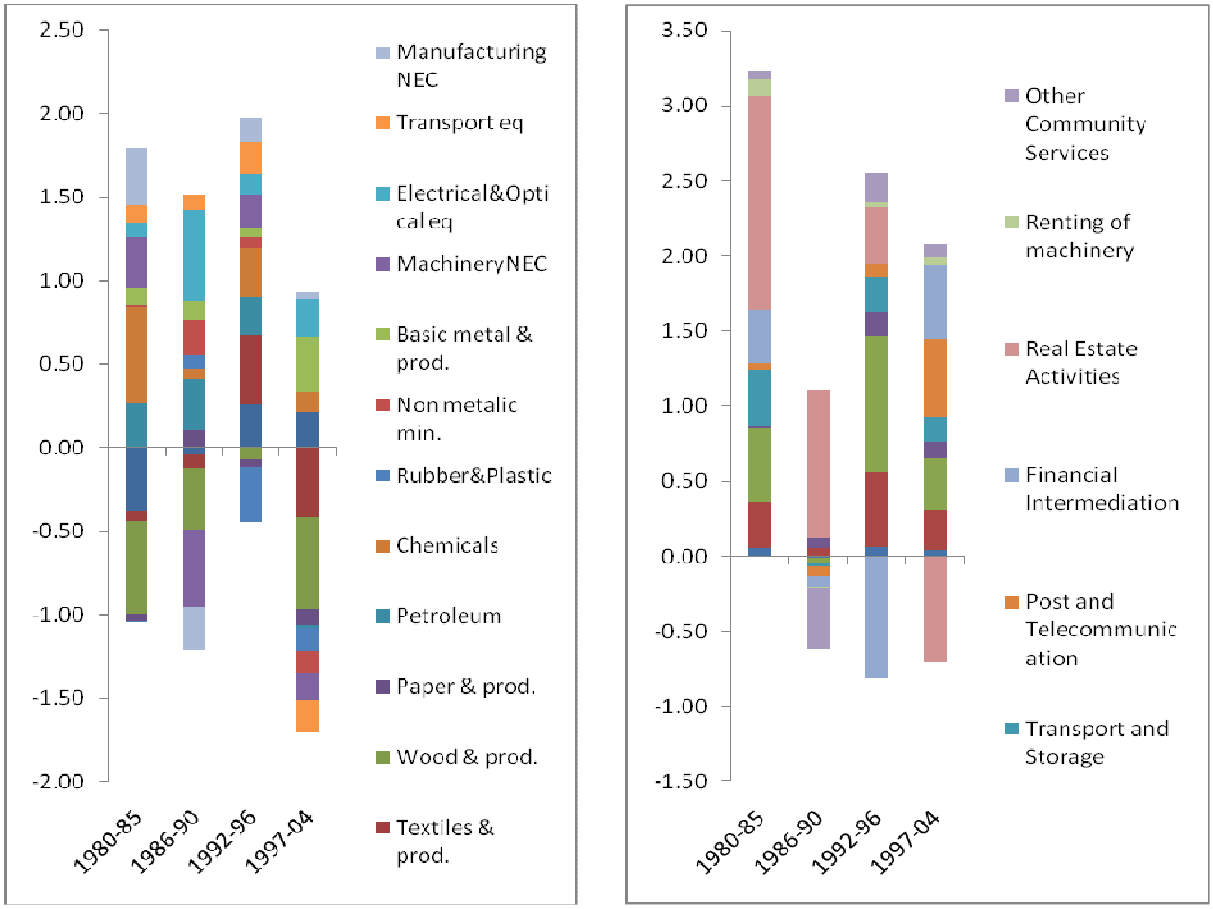
Table 8 provides Total factor productivity (TFP) growth rates computed using a growth accounting methodology where industry value added is a function of labor hours worked and capital stock. TFP growth is computed for 13 organized and unorganized manufacturing industries for the period 1980-2004 and the sub periods. We find that the productivity growth exhibited by the organized sectors is relatively better than the unorganized counterparts throughout the period. This holds true for the sub periods as well. The sectors which have improved their TFP growth rates in the 1980s (Food, beverages and tobacco; Pulp, paper and printing; other nonmetallic minerals and basic and fabricated metals) and in the 1990s (Rubber and plastics, basic metals and fabricated metal products and electrical and optical equipment) are amongst the few industries, where we find evidence of evidence of productivity enhancement following widespread reforms in areas of production and trade encompassing both organized and unorganized manufacturing.

It is interesting to compare the organized and unorganized TFP growth for the select industries mentioned in the previous paragraph in order to infer where did the overall productivity growth dynamism come from? In the case of 1980s, for Food, beverages and tobacco, we find that the positive TFP growth took place in the organized segment, while the unorganized sector was still in the realm of negligible growth. The same holds for pulp, paper and printing and other metallic minerals. In the case of basic metals and fabricated metals, we however find that the relative improvement in the unorganized TFP growth is resulting in the improved performance of this sector as a whole in the 1980s. Basic metals and fabricated metal products is the only sector which sustains its improved performance in the 1990 and it is interesting to note that though the unorganized sector sustains its improvement in TFP growth, the organized segment also contributes to the overall performance. The two new industries in the 1990s namely- rubber and plastics and electrical equipment and optical equipment - TFP performance were entirely based on the unorganized segment TFP growth which shows an appreciable jump as compared to the organized segment. Thus, in general, the TFPG in some sectors are driven by organized sector, while in some others it comes from unorganized. For instance in petroleum refining industry, the entire TFPG both in 1980s and 1990s is coming from the organized segment. This may largely be due to the fact that the unorganized sector activity in this industry is very minimal and low productive. In the electrical and optical equipment industry, we see a drastic shift in the productivity in organized and unorganized sectors. While in the 1980s, it was mainly in the unorganized sector, in the 1990s it comes mainly from the organized sector. It requires further analysis to draw firm conclusions about the relative performance of these sectors by looking at the contribution of these sectors to the total manufacturing productivity, which is not attempted in the present paper.

Sectoral Contributions to TFP growth-Manufacturing and Services

Having examined the roles of TFPG and factor inputs in driving growth in aggregate economy and its subsectors, it is important also to understand which of the subsectors are driving the observed aggregate productivity growth. For India it is now been established that while India's share of services went up in value added between 1980-2000, the share of manufacturing in value added has stagnated at less than 20 percent for past several decades. Further while the period of 1990s has seen the growth momentum driven by service sector, there still remain several barriers to improving manufacturing growth. Our analysis also confirms that the significant contribution to the aggregate value added growth for the period 1980-2004 comes from the services sector. Industry including manufacturing comes a distant second. Further, when we look at the TFPG contributions of the broad sectors to the overall growth, we again find that services contribution is the dominant. The next best contributors are Agriculture and Manufacturing sectors. It would be important to ascertain which of the sectors are contributing to the overall service sector's productivity performance and also contrast that with the sectoral contribution of manufacturing. In what follows, we examine further the contribution of sub-sectors of manufacturing and services to the aggregate manufacturing and services TFPG.

FIG 2: Sectoral contribution to aggregate manufacturing and services productivity



Source: India KLEMS database

Figure 2 captures the contribution of the sectors within services which are pushing the TFP growth performance. Looking at the start of the period, in the 1980-85, we find the substantial contribution from real estate sector. The 1990s however shows the emergence of several new sectors within services - retail trade, transport and storage, post and telecommunication in the first half along with real estate. The second half of 1990s sees the rapid rise of financial intermediation, post and telecommunication and retail trade as major contributors of service sectors TFP growth. It is interesting to also note the decline in the performance of real estate in the second half. Thus the rapidly expanding service sectors such as financial and communication services which are also relatively high ICT intensive sectors, seems to be driving the productivity growth in the services sector in the 1990s.

Manufacturing on the other hand, shows a wide range of individual sectors which have been contributing to the productivity. An important observation is that the electrical and optical equipment sector has been a major contributor in driving manufacturing productivity up, mainly since the late 1980s. This has further gained significance in the 1990s and 2000s. It may be noted that this sector includes the production of ICT goods, which has witnessed significant productivity improvement during the last two decades, due to rapid advancement in the technology. In the early 1990s, chemicals (1980-85), electrical equipment, petroleum, and rubber and plastic sectors contributed in driving the productivity growth. In the late 1990s through 2000s, basic metals and rubber and plastic along with electrical and optical equipment were crucial in driving TFPG, while non-metallic minerals and wood and wood products were the sectors that were dragging the TFPG in aggregate manufacturing down.

5. Conclusions

The paper attempted to examine the sources of growth in Indian economy for the period 1980-2005 using a newly developed India KLEMS database. In particular, it examines the relative contributions of factor accumulation and productivity growth in various sectors of the Indian economy. A sector perspective gains significance in the context of major reforms in economic policies witnessed across all the major sectors in the past two decades. The introduction of market friendly policies in the early 1990s was expected to make the economy more efficient and competitive. In addition, there has been significant structural transformation in the economy during the past decade. Evidences suggest a high and increasing share of service sector GDP.

In order to decompose output growth into contributions of inputs and factor productivity, we developed an India KLEMS database, in line of EU KLEMS using statistical information available with the Central Statistical Organization (CSO), India. This new dataset includes labor and capital accounts, measured using Jorgenson's methodology. Labor input is measured as total hours worked and labor composition, where the latter is measured after weighting different types of employment by their wage shares. Similarly capital input is measured as capital services, taking account of heterogeneity in various assets, such as ICT and non-ICT. In constructing this database we exploited various data sources, such as national accounts, input-output tables, and household employment surveys. The India KLEMS database was created keeping in mind consistency with the national accounts database of CSO. This data set enabled us to construct measures of value added, capital input, labour input and total factor productivity growth for

broad sectors of Indian economy and 31 sector India KLEMS industrial classification. Further, the productivity performance of the manufacturing sector also documents separately the performance of the organized and unorganized manufacturing.

With the creation of the large India KLEMS dataset, it was possible to get a detailed account of India's growth and its sources. Our findings are preliminary estimates, yet offers important insights into the Indian economy at the disaggregate level. There are three major observations. We find that the productivity performance of the Indian economy is moderate with sharp fluctuations. The economy wide productivity growth is service sector driven. The source of growth analysis shows that factor accumulation and not productivity drives the output growth. Our results are in line with some of the past studies on India's economic growth. The present makes important contribution to the literature on growth empirics in India. It is the most detailed industry perspective of Indian economy comprising 31sectors. The labour input reflects both quantity and quality aspects. The capital service contribution is categorized in terms of non ICT and ICT capital. The productivity performance is documented for both organized and unorganized manufacturing sectors.

The India KLEMS dataset constitutes a rich source for examining many pertinent research issues for the Indian economy at the sectoral level. Our future research agenda constitutes examining the contribution of intermediate inputs including services to the observed output growth in a KLEMS framework.

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Appendix 1

Gross Value Added Series- Adjustments

In KLEMS, output is adjusted for Financial Intermediation Services Indirectly Measured (FISIM). The value of such services forms a part of the income originating in the banking and insurance sector and, as such, is deducted from the GVA. The NAS provides output net of FISIM for some industry groups at a more aggregate level. For instance, in the estimates of GVA obtained for the registered manufacturing sector, adjustment for FISIM in NAS is made only at the aggregate level in the absence of adequate details at a disaggregate level. However, we have allocated FISIM to all the sectors of manufacturing by redistributing total FISIM across sectors proportional to their sectoral GDP shares. Similar redistribution of FISIM has been done in case of Trade sector and Other Services sector.

The KLEMS manufacturing industries where direct estimates were not available have been split-up using additional information from ASI and a few NSS surveys[25]. Given below is a list of KLEMS industries where we have split up the NAS gross value added as well as the methodology used for redistribution of value added data of some NAS sectors into different sub-sectors. However, it will be worthwhile to note that our aggregate estimate of GVA in manufacturing or other sectors below (formed from using the shares of ASI data and using results of unregistered manufacturing surveys), are consistent with the overall estimate of gross value added in the NAS.

Table 1: KLEMS Industries concordance with NAS industries

#	India KLEMS Industry List	NAS
1	Coke, Refined Petroleum Products and Nuclear Fuel (23)	Rubber, Petroleum Products etc. (23 + 25)
2	Rubber and Plastic Products (25)	
3	Basic Metals and Fabricated Metal Products (27+ 28)	Basic Metals (271+272+2731+2732)
4	Machinery, nec (29)	Metal Products and Machinery (28+29+30)
5	Electrical and Optical Equipment (30 to 33)	Electrical Machinery (31 + 32)
6	Manufacturing nec; recycling	'Other manufacturing' in NAS includes 33
7	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel (18)	Part of Trade in NAS
8	Wholesale and Commission Trade (19)	Trade
9	Retail Trade (20)	Trade
10	Real Estate Activities (25)	A part of 'Real estate, ownership of dwellings & business services' in NAS
11	Renting of Machinery & Equipment and Other Business Activities (26)	Real estate, ownership of dwellings & business services

Note: Manufacture of fabricated metal products (28) ; Manufacture of machinery and equipment n.e.c (29); Manufacture of office, accounting and computing machinery (30); Manufacture of electrical machinery and apparatus n.e.c. (31) + Manufacture of radio, television and communication equipment and apparatus (32) + Manufacture of medical, precision and optical instruments (33).

[25] A detailed methodology on the splitting and construction of the value added series is available in Wadhwa (2010)

Appendix 2

Definitions of Employment in NSSO employment & unemployment surveys

The surveys of NSSO on employment and unemployment aim to measure the extent of 'employment' and 'unemployment' in quantitative terms disaggregated by various household and population characteristics following the three reference periods of (i) one year, (ii) one week, and (iii) each day of the week. Based on these three reference periods three different measures, termed as *usual status*, *current weekly status*, and the *current daily status*, are arrived at. While all these three approaches are used for collection of data on employment and unemployment in the Quinquennial surveys, the first two approaches only are used for the purpose in the annual surveys.

Usual principal status: In NSS 27th round, the usual principal activity category of the persons was determined by considering the normal working pattern, i.e., the activity pursued by them over a long period in the past and which was likely to continue in the future. For the identification of the usual principal status of an individual based on the major time criterion, in NSS 27th, 32nd, 38th, 43rd rounds, a trichotomous classification of the population was followed, that is, a person was classified into one of the three broad groups 'employed', 'unemployed' and 'out of labour force' based on the major time criterion. From NSS 50th round onwards, the procedure was changed and the prescribed procedure was a two stage dichotomous one which involved a classification on the major time criterion into 'labour force' and 'out labour force' in the first stage, and thereafter, the labour force into 'employed' and 'unemployed' in the second stage.

***Usual subsidiary status*:** In the usual status approach, besides principal status, information in respect of subsidiary economic status of an individual was collected in all employment and unemployment surveys. For deciding the subsidiary economic status of an individual, no minimum number of days of work during the last 365 days was mentioned prior to NSS 61st round. In NSS 61st round, a minimum of 30 days of work, among other things, during the last 365 days, was considered necessary for classification as usual subsidiary economic activity of an individual.

***Current weekly status*:** It is important to note at the beginning that in the EUS of NSSO, a person is considered as worker if he/she has performed any economic activity at least for one hour on any day of the reference week and uses the priority criteria in assigning work activity status. This definition is consistent with the ILO convention and used by most of the countries in the world for their labour force surveys. In NSSO, prior to NSS 50th round and in all the annual surveys till NSS 59th round, data on employment and unemployment in the CWS approach was collected by putting a single-shot question 'whether worked for at least one hour on any day during the last 7 days preceding the date of survey'. The information so collected was used to determine the CWS of the individuals. This procedure was criticized for being not able to identify the entire workforce, particularly among the women. It was then decided to derive the CWS of a person from the time disposition of the household members for the 7 days preceding the date of survey. The procedure was used for the first time in NSS 50th round. It is seen that the change in the method of determining the current weekly activity had resulted in increasing the WPR in current weekly status approach - more so for the females in both rural and urban areas than for males. The trend observed in NSS 50th round in respect of the WPR according to CWS

suggested continuing with the procedure for data collection in CWS in NSS 55th and NSS 61st rounds.

Current Daily Status: Current Daily Status (CDS) rates are used for studying intensity of work. These are computed on the basis of the information on employment and unemployment recorded for the 14 half days of the reference week. The employment statuses during the seven days are recorded in terms of half or full intensities. An hour or more but less than four hours is taken as half intensity and four hours or more is taken as full intensity. An advantage of this approach was that it was based on more complete information; it embodied the time utilization, and did not accord priority to labour force over outside the labour force or work over unemployment, except in marginal cases. A disadvantage was that it related to person-days, not persons. Hence it had to be used with some caution.

Appendix Tables:

Table 1: Value Added shares by periods

NIC Code	KLEMS INDUSTRIES	1980	1986	1992	1997	2004
01 to 05	Agriculture, hunting, forestry & fishing	0.379	0.334	0.307	0.260	0.202
10 to 14	Mining & quarrying	0.020	0.024	0.026	0.025	0.022
15 to 16	Food , beverages & tobacco	0.019	0.021	0.020	0.023	0.021
17 to 19	Textiles, leather & footwear	0.026	0.024	0.023	0.025	0.021
20	Wood & products of wood	0.022	0.015	0.008	0.008	0.003
21 to 22	Pulp, paper , printing & publishing	0.005	0.006	0.005	0.005	0.005
23	Coke, refined petroleum & nuclear fuel	0.002	0.004	0.005	0.003	0.006
24	Chemicals & chemical products	0.012	0.014	0.020	0.022	0.026
25	Rubber & plastics	0.003	0.005	0.005	0.007	0.004
26	Other non-metallic mineral	0.005	0.006	0.007	0.008	0.007
27 to 28	Basic metals & fabricated metal	0.020	0.018	0.019	0.022	0.022
29	Machinery, nec	0.009	0.010	0.008	0.009	0.008
30 to 33	Electrical & optical equipment	0.007	0.012	0.011	0.011	0.014
34 to 35	Transport equipment	0.006	0.008	0.006	0.009	0.009
36	Manufacturing nec; recycling	0.002	0.003	0.003	0.006	0.005
40 to 41	Electricity, gas & water supply	0.016	0.020	0.024	0.025	0.023
45	Construction	0.066	0.058	0.060	0.056	0.066
50	Sale & maintenance of motor vehicles & motorcycles; retail sale of fuel	0.005	0.005	0.005	0.006	0.007
51	Wholesale trade	0.033	0.035	0.035	0.040	0.050
52	Retail trade	0.068	0.073	0.071	0.082	0.084
55	Hotels & restaurants	0.008	0.008	0.009	0.011	0.014
60 to 63	Transport & storage	0.053	0.057	0.057	0.059	0.066
64	Post & telecommunications	0.007	0.007	0.008	0.012	0.036
65 to 67	Financial intermediation	0.024	0.034	0.044	0.055	0.059
70	Real estate activities	0.045	0.054	0.063	0.057	0.045
71 to 74	Renting of machinery & equipment	0.005	0.008	0.009	0.014	0.033
75	Public admin & defence	0.057	0.064	0.064	0.062	0.060
80	Education	0.027	0.029	0.031	0.035	0.039
85	Health & social work	0.010	0.012	0.013	0.014	0.018
90 to 93	Other community, social & personal services	0.032	0.029	0.029	0.025	0.023
95	Private households with employed persons	0.004	0.003	0.003	0.002	0.002

Note: The value added shares are computed at the beginning of each time period and for the end year of the study.
Source: India KLEMS database

Table 2: Growth rate of Labour Input

NIC Code	KLEMS INDUSTRIES	1980 - 1985	1986 -1990	1992 - 1996	1997 - 2004	1980 - 2004
01 to 05	Agriculture, hunting, forestry & fishing	0.63	1.19	1.46	0.84	1.00
10 to 14	Mining & quarrying	5.31	4.86	-0.05	2.53	3.08
15 to 16	Food , beverages & tobacco	1.54	3.14	3.18	1.64	2.28
17 to 19	Textiles, leather & footwear	2.46	1.34	-1.98	7.05	2.85
20	Wood & products of wood	1.64	-1.83	1.62	4.17	1.76
21 to 22	Pulp, paper , printing & publishing	5.66	4.70	4.77	6.25	5.47
23	Coke, refined petroleum & nuclear fuel	9.83	12.80	8.11	-3.41	5.50
24	Chemicals & chemical products	3.17	5.78	3.76	2.86	3.76
25	Rubber & plastics	8.06	12.28	10.12	0.96	6.96
26	Other non-metallic mineral	2.48	1.93	2.02	4.32	2.90
27 to 28	Basic metals & fabricated metal	3.40	4.01	4.13	3.02	3.56
29	Machinery, nec	-1.90	17.80	4.47	1.22	4.85
30 to 33	Electrical & optical equipment	5.36	8.54	7.25	2.19	5.36
34 to 35	Transport equipment	5.05	4.58	0.52	9.27	5.43
36	Manufacturing nec; recycling	6.50	5.26	1.85	5.45	4.86
40 to 41	Electricity, gas & water supply	4.49	6.82	0.84	1.91	3.30
45	Construction	11.68	5.90	5.25	7.18	7.46
50	Sale & maintenance of motor vehicles & motorcycles; retail sale of fuel	3.08	10.46	8.28	6.31	6.94
51	Wholesale trade	3.49	7.25	3.70	5.77	5.15
52	Retail trade	3.98	6.50	5.60	3.94	4.86
55	Hotels & restaurants	2.60	4.31	5.76	5.82	4.78
60 to 63	Transport & storage	3.00	6.21	6.33	5.19	5.18
64	Post & telecommunications	0.17	8.06	10.20	9.54	7.32
65 to 67	Financial intermediation	5.02	10.71	5.34	5.37	6.45
70	Real estate activities	5.34	15.40	5.73	16.38	11.45
71 to 74	Renting of machinery & equipment	5.27	9.16	12.59	11.47	9.86
75	Public admin & defence	3.99	5.24	2.61	-0.73	2.32
80	Education	1.41	7.99	6.03	6.27	5.54
85	Health & social work	1.36	5.00	6.14	6.29	4.91
90 to 93	Other community, social & personal services	1.49	10.13	5.82	0.37	3.92
95	Private households with employed persons	-0.78	0.78	-0.89	12.86	4.28
	Industry Mean	3.70	6.65	4.53	4.91	4.95
	Industry Median	3.40	5.90	4.77	5.19	4.86

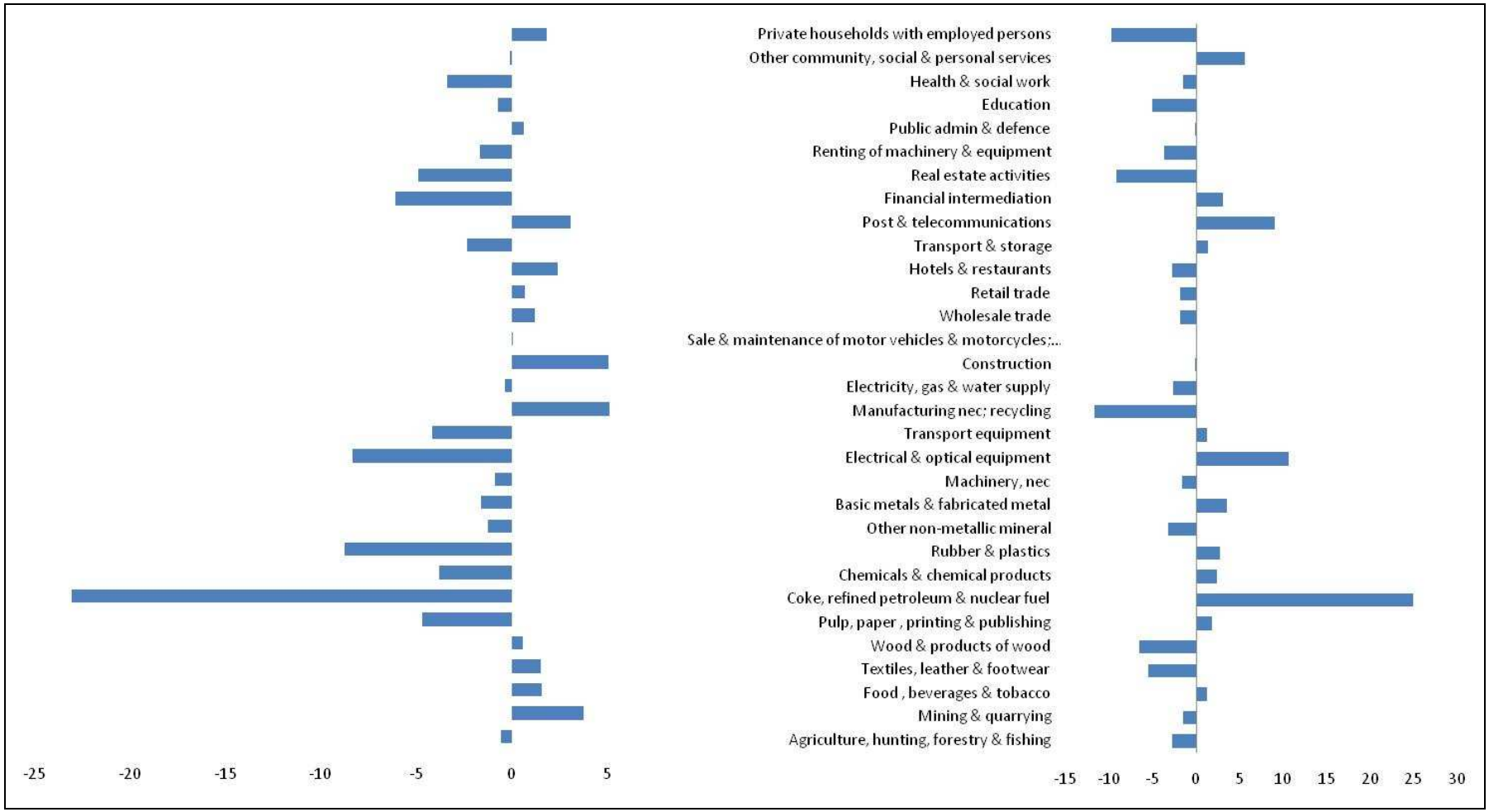
Source: India KLEMS database

Table 3: Growth rate of Capital Input

NIC Code	KLEMS INDUSTRIES	1980 - 1985	1986 -1990	1992 - 1996	1997 - 2004	1980 - 2004
01 to 05	Agriculture, hunting, forestry & fishing	2.37	2.61	2.61	4.73	3.29
10 to 14	Mining & quarrying	15.43	9.99	6.10	2.98	7.89
15 to 16	Food , beverages & tobacco	13.95	7.47	5.85	4.54	7.51
17 to 19	Textiles, leather & footwear	4.31	7.74	12.55	6.68	7.67
20	Wood & products of wood	9.15	8.90	9.87	13.37	10.72
21 to 22	Pulp, paper , printing & publishing	8.39	7.80	5.40	6.40	6.92
23	Coke, refined petroleum & nuclear fuel	0.48	3.97	9.10	13.04	7.48
24	Chemicals & chemical products	3.93	10.86	11.48	7.09	8.18
25	Rubber & plastics	8.40	11.14	18.54	4.85	9.96
26	Other non-metallic mineral	13.67	5.03	9.70	7.07	8.64
27 to 28	Basic metals & fabricated metal	3.39	8.02	10.01	2.25	5.44
29	Machinery, nec	6.93	7.50	7.46	6.91	7.16
30 to 33	Electrical & optical equipment	9.08	7.43	7.67	6.95	7.67
34 to 35	Transport equipment	3.60	7.33	13.77	9.78	8.77
36	Manufacturing nec; recycling	9.64	8.91	10.77	10.05	9.87
40 to 41	Electricity, gas & water supply	8.41	9.01	5.91	5.18	6.88
45	Construction	4.62	6.24	5.98	12.36	7.96
50	Sale & maintenance of motor vehicles & motorcycles; retail sale of fuel	2.77	4.46	4.69	6.64	4.90
51	Wholesale trade	2.77	4.46	4.69	6.73	4.93
52	Retail trade	2.77	4.46	4.69	6.07	4.70
55	Hotels & restaurants	8.59	7.99	6.05	5.23	6.74
60 to 63	Transport & storage	2.97	5.56	5.40	7.08	5.49
64	Post & telecommunications	8.00	10.69	11.49	9.28	9.79
65 to 67	Financial intermediation	8.33	12.30	21.08	4.52	10.64
70	Real estate activities	0.76	1.99	2.90	5.44	3.12
71 to 74	Renting of machinery & equipment	3.58	6.54	10.48	20.51	11.61
75	Public admin & defence	5.72	4.74	4.15	4.84	4.86
80	Education	5.82	8.52	7.74	13.16	9.38
85	Health & social work	7.12	9.78	8.50	13.93	10.37
90 to 93	Other community, social & personal services	2.93	4.32	4.67	7.77	5.29
95	Private households with employed persons	2.87	4.10	3.08	7.53	4.80
	Industry Mean	6.15	7.09	8.14	7.84	7.38
	Industry Median	5.72	7.47	7.46	6.91	7.51

Source: India KLEMS database

Fi g 1: Growth difference of TFP between 1990s and 1980s & 2000s and 1990s



Note: The figure above depicts the growth difference in TFP between 1990 and 1980 (left panel) and that between 2000s and 1990s (right panel)
Source: India KLEMS database