



GROWTH ACCOUNTING ANALYSIS OF THE INDIAN ECONOMY – WITH SPECIAL REFERENCE TO THE ECONOMIES OF BIHAR & JHARKHAND DURING 2000-2021

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Abstract: The present study endeavors to estimate in quantitative terms, the role played by Total Factor Productivity (TFP) as a source of economic growth in the overall Indian economy, spanning 2000-01 to 2020-21 using Index Number Approach with special reference to Bihar and Jharkhand, two adjoining developing states of India. The analysis has revealed that in a majority of sectors of Jharkhand state and the overall Indian economy, output growth was faster than input growth, but none of the sectors in Bihar experienced such a phenomenon. However, Jharkhand reported lower capital growth (0.91%) in comparison to 6.35% in Bihar and 5.50% in the overall Indian economy. Further, in both the states, TFP contributed the most to output growth during the initial ten years, while the labor force acted as a prime mover during the last ten years of the study period. However, in the Indian economy as a whole, TFP continued to be the major source of economic growth during the entire study span of two decades. Thus, although the Government policy seems to have paid dividends in the country as a whole, there have been considerable variations in the pace and extent of implementation of the policy across these two states. Consequently, for states (like Bihar) to surge ahead, it is important to address regional problems to enhance TFP, which has become virtually synonymous with economic growth.

Keywords: Growth Accounting; Total Factor Productivity; Factor Share Approach; Kendrick Index; Solow Index; Translog Index; Perpetual Inventory Method.

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1. INTRODUCTION

Growth Accounting Framework has been extensively used in the economic

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literature since the second half of the twentieth century to shed light on the ultimate source of growth and to estimate trends in productivity { Abramovitz (1956) (1); Kendrick (1961)(2); Solow (1957) (3)}. Two distinct sources, viz., factor inputs and productivity govern the growth of the economy. The input-driven growth is achieved through an increase in factors of production. The productivity-driven growth (that cannot be explained by the growth in total inputs) is attributed to several components that consist of technological progress, efficient use of resources, enhancement of information technology, improvement in organization, human resource management, etc. The field of growth accounting has seen major theoretical contributions through the importance of investment in human, physical and intangible capital. Jorgenson(1987)(4) developed a general input-output framework, explicitly accounting for the use of intermediate inputs, and integrated growth accounting with index number theory and national accounts. The potential value of growth accounting accrues in several ways – i) provides a useful diagnostics of strengths and weaknesses in growth performance; ii) delivers a deeper analysis of the growth process and permits the quantification of the contribution to growth made by a particular sector or new technologies; and, iii) explicitly offers valuable insights into the nature of productivity and the large differences in Total Factor Productivity (TRP) level across the regions/ countries.

The interdependence between the opportunities presented by the nature of technical change for capital accumulation and between the trajectory of physical and human capital formation and technological change. If technological change is taken to be endogenous the main implications are for the interpretations of the estimates of the sources of the growth rather than their construction. The direction of causality may be thought to run from the factor input growth to TRP growth rather than vice-versa. Growth accounting does not offer a way to test these hypotheses, so further evidence is required to obtain a deeper understanding of the growth process. Nevertheless, the insights of endogenous innovative models suggest possible ways to explore the underpinning of the residual.

An analysis of the behavioral characteristics of total factor productivity across sectors provides useful scope to understand how efficient use of technology has led to growth in output in an economy. It provides an important tool with which the growth experience of a country or region could be examined. Lucas (1988)(5) has stated, ‘The problem of economic development...is...simply the accounting of income. This explicitly addresses the issue of comparative economic development of states within India (which may be viewed as a

collection of interlinked sub-economies). In this context, an attempt has been made in this paper to measure the contribution of different factors to economic growth and to indirectly compute the rate of technological progress in major sectors of two developing adjoining states of Bihar and Jharkhand vis-à-vis the overall Indian economy covering the period from 2000- 01 to 2020-21.

2. LITERATURE REVIEW

Several studies related to various aspects of growth accounting and total factor productivity have been conducted in India and elsewhere. Denison(1967) (6) made an analytical comparison of sources of growth in the U.S. economy as against eight industrialized countries to observe that sources of growth vary in importance from time to time and place to place. Jorgenson & Griliches (1967)(7) found that most of the growth in the U.S. was due to the growth in total inputs rather than a change in TFP. Bhattacharya (1972) (8) analyzed the Indian economy to observe that the growth rate of output, as well as labor productivity in agriculture, was very low, and technological change virtually contributed nothing to output growth. Dholakia (1974) (9) conducted a detailed study of the factor productivity of the Indian economy during the post-independence period and revealed that the observed increase in the growth rate of real national income was mainly due to an increase in the growth rate of TFP and labor input rather than capital. Using Solow and Translog indexes, Ahluwalia (1985)(10) and Nagarajan (1985)(11) estimated TFP for the manufacturing sector of India, which pointed towards a marginal deterioration in the rate of growth in TFP over time. Krishna (1991)(12) examined the trends in output growth and TFP growth in the industrial sector in India from 1951 to 1986 and observed that the TFP growth in the organized manufacturing sector has grown at a meager rate of less than 0.1 percent per annum. Nehru and Dhareshwar (1993)(13) calculated TFP for a group of 92 developing and industrial countries' undergrowth accounting frameworks. As per their findings, TFP contributed more (than capital accumulation) to GDP growth in eight of the countries during the study span. By applying Kendrick, Solow, and translog indexes of TFP growth, Sethi (1997, 2005) (14,15) observed that the major contributors to the growth rate of primary, secondary, and tertiary sectors of India were labor, capital, and TFP, respectively. And, for the aggregated economy, the maximum contribution was attributed to labor input. Through the growth accounting framework, Dholakia (2001)(16) analyzed the sources of India's growth during the period 1960-61 to 2000-01 and found that 95 percent of the accelerated growth of GDP in the agricultural

sector during the post-liberalization period had resulted from increased growth of TFP, while the remaining could be attributed to increased growth of factor inputs. Covering the period from 1960-61 to 1996-97, Sethi and Raikhy (2001)(17) observed that for the Indian economy, the contribution of labor as a source of growth has increased while that of capital has decreased during the liberalization period. Gordon (2003)(18) noticed a negative contribution of capital to the slowdown in growth in output (of private non-farm business, manufacturing, and private non-farm non-manufacturing sectors) in the case of the U.S. and Canada, although it was positive in the case of Japan, France, and Germany. Using Kendrick, Solow, and translog indexes, Saravanan (2008) (19) measured TFPG for the manufacturing sector of 16 major states of India, spanning 1980-81 to 2005-06. The author observed that TFP growth has induced a slightly higher influence on the process of output growth during the 1990s *vis-à-vis* 1980s. Kumar and Kavita (2012)(20) observed that the TFP growth of the Indian manufacturing sector for all the states taken together and a few South-Indian states has declined during the post-reforms period *vis-à-vis* the pre-reforms period. Mamuneas and Ketteni (2012)(21) found that although the contribution of TFP in output was positive in the case of Cyprus, the contribution of both labor and TFP was negative in each of the Euro Area and Greece.

Various other studies, such as due by Krishna and Mehta (1961)(22), Brahmananda (1982)(23), Dholakia (1977, 2001)(24), Dholakia (1986, 2009) (25,26), Bosworth *et al.* (1995)(27), Barro (1999)(28), Goldar (2004)(29), Pendse and Baghel (2008)(30), *etc.*, have also dealt with the estimation of TFP in the context of Indian and other economies. Different studies have come out with varied conclusions regarding growth accounting, possibly due to differences in periods covered, regions considered, methodologies adopted, and the concepts of factor inputs and outputs. Moreover, a growth accounting study has been reported by Sethi & Kaur (2013)(31) in the context of the economies of Punjab and Haryana. The present investigation was undertaken to estimate the relative contribution of various factor inputs and TFP in the overall growth of Bihar and Jharkhand states *vis-à-vis* the Indian economy as a whole when the two states' economies were spilled *vis-à-vis* Indian economy for the period 2000-2021.

3. DATA

Data on the requisite aggregates, *viz.*, Net Domestic Product (NDP) and Net Fixed Capital Stock (NFCSS) (at both current and at constant prices) for the overall Indian economy were sourced from various issues of National Accounts

Statistics, while for Bihar and Jharkhand states, data on Net State Domestic Product (NSDP) were compiled from the Directorate of Economics & Statistics, Bihar and its sister organization in Jharkhand. Series on capital stock for the two states were generated through the *perpetual inventory method* (as per the detailed methodology outlined in Sinha & Verma, 2015(32); Sinha and Sinha, 2020(33)). Data on domestic product and capital stock were available in parts at differential base years; therefore, by making use of information in respect of the overlapping years, the time series were spliced together to get comparable series at 2011-12 constant prices. Data on the working force (taken as a *proxy* for labor force) were compiled for different sectors/ sub-sectors of the states of Bihar and Jharkhand, and the Indian economy in the census years of 2001, and 2011. Through the usual compound growth rate law, interpolations were made to generate regular time series on the working force in each of the activities. Information on distributive shares of factor incomes was compiled from various issues of National Accounts Statistics. It may be mentioned that the information was available in different formats for different periods and, therefore, could not be used as such due to non-comparability. Consequently, suitable adjustments had to be made to come out with a spliced time series on factor incomes into compensation to employees (as a reward for labor) and interest (as a reward for capital). It may further be pointed out that such data on factor incomes were not available at the states' level and, therefore, the same information (compiled at the national level) had to be used for the two states.

Clubbing of each of the aggregates (*viz.*, income, capital stock, working force, and factor incomes) was then made in respect of five major components *viz.*, (i) Primary [PRM, comprising of Agriculture and Allied Activities; Forestry and Logging; Fishing; and Mining & Quarrying]; (ii) Secondary [SEC, comprising of Registered Manufacturing; Unregistered Manufacturing; Construction; and Electricity, Gas & Water Supply]; (iii) Tertiary-1 [TR1, comprising of Railways; Transport by Other Means; Storage; Communication; and Trade, Hotels & Restaurants]; (iv) Tertiary-2 [TR2, comprising Banking & Insurance; Residential Buildings and Dwellings; Public Administration; and Other Services]; (v) Aggregated Tertiary [TRT, comprising of TR1 and TR2]; and (vi) Overall Aggregate [AGG, comprising of PRM, SEC, and TRT].

Comparable data on the six major components were compiled for Bihar & Jharkhand *vis-à-vis* the Indian economy as a whole for the period 2000-01 to 2020-21).

4. METHODOLOGY

Three principal approaches for measurement of productivity growth are used in the literature: (i) The Index Number Approach, (ii) Parametric Approach, and (iii) Non-Parametric Approach. This study is based on the first approach (of Index Numbers) for estimating productivity performance.

Total factor productivity analysis for each of the three economies was carried on by first converting time-series data on output (*i.e.*, real NDP/ NSDP) and each of the inputs *viz.*, labor and capital into index numbers (in line with Dholakia, 1974(9); Sethi, 1997(14); Sethi & Kaur, 2013(31)) by taking 2011-12 as the base year. Depending upon the underlying production function (or the aggregation scheme assumed), the following indexes of TFP were then computed:

4.1. Kendrick Index

Kendrick's (1961) index of total factor productivity is an arithmetic measure of the rate of technological change, which consists of first computing an index of total factor input (TFI) as a weighted combination of the individual indexes of the factors of production, TFP is then obtained as the ratio of output (or income, Y_t) to total factor input:

$$A_t = Y_t / (\alpha_0 L_t + \beta_0 K_t) \quad (1)$$

Three variants of the Kendrick index, *viz.*, KI1, KI2, and KI3 were determined depending on the different sets of weights attached to the factors of production. The sets of weights (*i.e.* α_0 and β_0) used in these indexes, respectively, were the relative shares of labor (L_t) and capital (K_t) in national income (a) during the base year, (b) averaged over base triennium, and (c) averaged over the entire study period.

The index is based on a linear homogeneous production function of degree one.

Besides constant returns to scale and neutral technical progress, it assumes an infinite elasticity of substitutability between labor and capital. The index can be generalized to allow for more than two factors. Although the index is easy to calculate and understand, it suffers from the inherent drawback that the underlying production function is assumed to be a linear one (which appears to be rather unrealistic) and that it does not allow for the possible diminishing marginal productivity of factors.

4.2. Solow Index

Solow's (1957)(3) index is based on a restricted version of the Cobb-Douglas production function, rather than a practically unrealistic linear production function, and expressed as

$$Y = A L^\alpha K^{(1-\alpha)} e^{u_t} \quad (2)$$

Taking log on both sides

$$\ln Y_t = \ln A_t + \alpha \ln L_t + (1 - \alpha) \ln K_t + u_t \quad (3)$$

where α and $(1-\alpha)$ refer to elasticities of output concerning labor and capital respectively; A_t measures, the accumulated effect of technical change is assumed to be both disembodied and Hicks neutral. This index, too, makes the assumptions of constant returns to scale, the existence of perfect competition in factor markets, and payment to factors according to their marginal products. Solow's measure of productivity growth and Solow index of TFP is then given by

$$\ln A_t = \ln Y_t - (1 - \alpha) \ln K_t - \alpha \ln L_t \quad (4)$$

By taking $A_0 = 1$, a Solow index of TFP was generated as

$$A_{t+1} = A_t (1 + \ln A_t) ; t=0,1,2,\dots,(n-1).$$

4.3. Translog (Divisia) Index

This index is based on a more versatile translog production function, expressed as

$$\ln Y_t = \ln \beta_0 + \beta_1 \ln L_t + \beta_2 \ln K_t + \beta_{11} (\ln L_t)^2 + \beta_{22} (\ln K_t)^2 + \beta_{12} \ln L_t \ln K_t + u_t \quad (5)$$

This index not only characterizes constant returns to scale but also allows for variable elasticity of substitution among the factor inputs. The basic equation of the translog index is given by

$$\ln(A_t / A_{t-1}) = \ln(Y_t / Y_{t-1}) - \{\beta^{-1} \ln(L_t / L_{t-1}) + \beta^{-2} \ln(K_t / K_{t-1})\} = g^{TL} \quad (6)$$

Where \ln represents natural logarithm and two β 's represent average share (averaged over two consecutive years) of labor and capital respectively. This index expresses TFP as the difference between the growth rate of output and the weighted average of growth rates of labor and capital inputs. This is equivalent of Tornquist's discrete approximation to the continuous Divisia index (Korres and Polychronopoulos, 2008(35)).

From equation (6), the translog index of TFP was generated through the relation

$$A_t = A_{t-1} \exp (g^{TL}) \quad (7)$$

4.4. Growth Accounting Analysis

Growth accounting was done through the contribution made by a given factor input to the growth rate of aggregated income and was estimated as the product of the growth rate of factor input (which was peculiar to the index chosen) with its relative share in the aggregated income.

5. RESULTS

5.1. Indexes for Output & Factor Input

A time series of the Net State Domestic Product (NSDP)(Y); working force (L); and Net Fixed Capital Stock (NFCS)(K) were obtained to construct related indexes for the major sectors of the economies of Bihar, Jharkhand, and India as a whole. Bihar and Jharkhand do not have a series on capital stock, so these were generated through the *perpetual inventory method* [as per the detailed methodology outlined in Sinha & Verma,2015(33); Sinha and Sinha, 2020(34)]. Tables -1, 2, & 3 provide time-series indexes with a base of 2000-01 on Y, L,& K for the five major sectors. These tables lead to the following results :

- i) Bihar: a) The secondary sector has experienced the fastest growth in respect of output (at 6.3 percent per annum) as well as in both the inputs (working force at a rate of 6.4 and capital stock at 10.1 percent per annum; Table 1) in comparison to Jharkhand and overall Indian economy. b) A relatively slower rate of growth in output *vis-à-vis* the rates in each of the factor inputs has pointed towards a deceleration in the productivity growth rate of the Tertiary-2 sector. c) A similar situation was witnessed in Tertiary-1 and Aggregated Tertiary sectors as well. d) In a primary sector as also in the overall Bihar economy, the pace of output growth was faster than that in the working force but slower than the growth rate in capital stock. e) Tertiary-2 was the lone exception, wherein the rate of growth in output (at 3.1 percent per annum) was significantly slower than that in the working force (at 6.1 percent per annum), but was faster than the rate in capital stock (at 2.6 percent per annum).

- ii) Jharkhand: a) Output growth outstripped growth in inputs in all the sectors (except the Tertiary-2 sector), thereby indicating comparatively higher productivity performance (Table 2). b) Income growth was the fastest (equaling 9.6 percent per annum) in the Tertiary-1 sector, while growth in inputs was the fastest in the Tertiary-2 sector. c) Notably, capital stock in the secondary sector of the state experienced a U-shaped pattern, thus registering an overall rate of growth close to zero.
- (iii) The overall Indian Economy: a) It has witnessed income to have grown at the fastest rate (equaling 7.9 percent per annum) in the Tertiary-2 sector, while both the inputs experienced the fastest growth rate in the Secondary sector (Table 3). b) In the Tertiary sector as well as in the overall economy, the rate of output growth was higher than that in each of the inputs. c) However, in the Primary as well as Secondary sectors, growth in capital stock was faster than that in income.
- (iv) In a majority of the activities in Jharkhand state as also in the overall Indian economy, output growth was faster than growth in inputs. But Jharkhand reported very lower capital growth (0.91%) in comparison to 6.35% in Bihar and 5.50% in the overall Indian economy.
- (v) Output growth experienced slower growth than growth in inputs in most of the sectors in the case of Bihar. However, capital growth was better in Bihar than in the overall Indian economy.

5.2. Total Factor Productivity

The three different indexes of Total Factor Productivity (TFP) (*viz.*, Kendrick, Solow, and Translog) were constructed for each of the three economies: Bihar (Table 4), Jharkhand (Table 5), and India (Table 6). A broad look at the tables evinces that the three indexes of TFP were in close agreement with each other in the sense that each one of these exhibited a similar pattern of TFP changes over the study span. In all three economies, the TFP values portrayed wide fluctuations in both primary and secondary sectors in comparison to such fluctuations in the Tertiary sector. At the aggregated level, TFP values in Bihar have fluctuated around unity, whereas in Jharkhand (as also in the overall Indian economy), the values happened to exceed even two at certain points in time. Thus, the temporal behavior of the TFP values could provide us with preliminary information that productivity performance in the case of Jharkhand and the overall Indian economy were almost similar, and were better than the Bihar.

Table 1: Time Series Indexes (with 2000-1 as Base Year) for NSDP (Y), Working Force (L), and NFCS (K) and Major Sectors – Bihar

Year	Primary			Secondary			Tertiary-1			Tertiary-2			Tertiary			Aggregated economy		
	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.142	1.019	1.083	1.112	1.029	1.246	1.084	1.061	1.107	1.058	1.076	0.913	1.067	1.068	0.994	1.103	1.033	1.038
2004-05	1.251	1.039	1.181	1.231	1.063	1.967	1.139	1.125	1.227	1.135	1.158	0.863	1.136	1.141	1.014	1.196	1.067	1.148
2006-07	1.352	1.059	1.303	1.438	1.101	2.080	1.264	1.194	1.363	1.223	1.247	0.867	1.238	1.220	1.073	1.314	1.104	1.225
2008-09	1.474	1.080	1.459	1.660	1.143	2.774	1.343	1.267	1.515	1.323	1.342	0.911	1.330	1.303	1.162	1.439	1.143	1.392
2010-11	1.615	1.101	1.632	1.870	1.190	3.885	1.370	1.344	1.829	1.427	1.444	0.940	1.407	1.393	1.309	1.563	1.184	1.647
2012-13	1.773	1.105	1.815	2.084	1.383	5.061	1.477	1.540	1.994	1.492	1.655	0.925	1.487	1.596	1.369	1.695	1.263	1.849
2014-15	1.873	1.109	1.951	2.428	1.610	6.378	1.550	1.765	2.504	1.509	1.896	1.038	1.523	1.829	1.647	1.806	1.355	2.210
2016-17	1.999	1.114	2.058	2.702	1.878	9.102	1.816	2.023	2.848	1.696	2.173	1.058	1.738	2.096	1.801	1.996	1.461	2.627
2018-19	1.962	1.119	2.260	3.349	2.196	9.262	2.072	2.318	3.274	1.875	2.489	1.175	1.945	2.401	2.046	2.180	1.584	2.855
2020-21	2.171	1.124	2.433	3.478	2.574	9.657	2.397	2.656	3.763	2.024	2.853	1.350	2.156	2.752	2.352	2.377	1.726	3.144
GR (%)	3.15	0.45	4.15	6.35	6.39	10.11	5.18	5.89	7.51	3.72	6.11	2.58	4.29	6.00	5.55	4.33	3.52	6.35

Table 2: Time Series Indexes (with 2000-01 as Base Year) for NSDP (Y), Working Force (L), and NFCS (K) and Major Sectors – Jharkhand

Year	Primary			Secondary			Tertiary-1			Tertiary-2			Tertiary			Aggregated Economy		
	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.029	1.032	1.031	1.044	1.016	0.794	1.296	1.071	1.049	1.134	1.115	1.027	1.195	1.094	1.035	1.084	1.043	0.848
2004-05	1.060	1.066	1.049	1.155	1.034	0.640	1.261	1.146	1.000	1.250	1.244	1.034	1.254	1.198	1.021	1.146	1.088	0.726
2006-07	1.160	1.101	1.094	1.451	1.054	0.521	1.565	1.228	0.996	1.415	1.387	1.096	1.472	1.312	1.058	1.336	1.138	0.642
2008-09	1.405	1.139	1.083	1.645	1.076	0.442	1.972	1.315	0.993	1.543	1.547	1.134	1.705	1.437	1.080	1.564	1.191	0.583
2010-11	1.554	1.178	1.094	1.829	1.099	0.380	2.267	1.408	0.962	1.869	1.726	1.165	2.019	1.575	1.088	1.772	1.249	0.537
2012-13	1.574	1.259	1.131	1.803	1.273	0.333	2.419	1.616	1.019	2.012	1.982	1.184	2.165	1.808	1.122	1.818	1.374	0.509
2014-05	1.718	1.347	1.181	2.109	1.474	0.312	2.686	1.856	1.030	2.166	2.275	1.235	2.362	2.076	1.157	2.024	1.515	0.501
2016-17	1.824	1.440	1.238	2.340	1.708	0.318	3.521	2.131	1.036	2.492	2.612	1.353	2.880	2.384	1.233	2.289	1.673	0.521
2018-19	1.713	1.541	1.344	2.612	1.980	0.343	3.890	2.446	1.072	2.916	2.999	1.452	3.283	2.737	1.307	2.442	1.850	0.559
2020-21	1.845	1.649	1.491	2.61	2.297	0.400	5.466	2.809	1.104	2.841	3.444	1.513	3.831	3.143	1.358	2.662	2.049	0.622
GR(%)	3.10	2.94	2.69	6.00	5.76	-0.06	9.65	6.11	1.28	6.63	6.72	3.26	8.04	6.45	2.62	5.99	4.37	0.91

Table 3: Time Series Indexes (with 2000-01 as Base Year) for NDP (Y), Working Force (L), and NFCS (K) and Major Sectors – India

Year	Primary			Secondary			Tertiary-1			Tertiary-2			Tertiary			Aggregated Economy		
	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K	Y	L	K
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.050	1.042	1.086	1.066	1.034	1.158	1.122	1.073	1.055	1.147	1.085	1.052	1.135	1.079	1.053	1.085	1.047	1.084
2004-05	1.151	1.086	1.176	1.205	1.070	1.332	1.236	1.152	1.106	1.321	1.178	1.110	1.281	1.165	1.109	1.211	1.097	1.173
2006-07	1.159	1.133	1.261	1.306	1.109	1.537	1.419	1.237	1.179	1.562	1.279	1.174	1.496	1.257	1.175	1.315	1.150	1.275
2008-09	1.309	1.181	1.352	1.491	1.150	1.766	1.579	1.328	1.291	1.820	1.388	1.253	1.709	1.357	1.261	1.496	1.206	1.394
2010-11	1.393	1.232	1.463	1.725	1.194	2.035	1.783	1.426	1.437	2.152	1.507	1.353	1.981	1.465	1.371	1.682	1.265	1.539
2012-13	1.446	1.269	1.534	1.748	1.324	2.314	1.920	1.554	1.582	2.422	1.635	1.462	2.190	1.594	1.488	1.786	1.329	1.682
2014-15	1.562	1.309	1.625	2.034	1.474	2.607	2.261	1.694	1.764	2.683	1.775	1.592	2.487	1.733	1.629	2.006	1.400	1.847
2016-17	1.693	1.351	1.684	2.447	1.646	3.105	2.788	1.846	1.960	3.093	1.926	1.729	2.952	1.885	1.779	2.322	1.477	2.055
2018-19	1.766	1.397	1.737	2.574	1.844	3.668	3.237	2.012	2.141	3.709	2.091	1.903	3.490	2.050	1.954	2.577	1.562	2.291
2020-21	1.814	1.445	1.823	2.852	2.072	4.120	3.741	2.194	2.434	4.263	2.269	2.154	4.021	2.230	2.214	2.853	1.655	2.556
GR(%)	2.94	1.82	3.12	6.00	4.75	7.50	7.89	4.18	5.75	7.48	4.18	4.92	7.67	4.18	5.11	5.88	2.75	5.50

Conditions underlying these three indices should be examined for carrying out further analysis. The Kendrick index was the easiest to compute, but its major drawback lay in the rather unrealistic assumption of the underlying linear production function. Solow index is, undoubtedly, a refinement over the Kendrick index, but the (former) index happens to be restrictive in the sense that it is based on the restricted version of the Cobb-Douglas production function, which assumes not only constant returns to scale but also unitary elasticity of substitution between the factors of production. On the other hand, a limitation of the Translog (Divisia) index lies in its computational complexity. Nevertheless, the index is based on a more versatile Translog production function that allows for varying elasticity of substitution and factor combinations and is therefore capable of providing more realistic values of TFP. This study, thus, relies upon the results obtained through the Translog index for the subsequent analysis.

A broad look at the values of the Translog index reveals that, in both the states as well the overall Indian economy, the pattern of productivity changes has all along been highly erratic in the primary sector during the study span. The likely reason could be that the agriculture sector depends primarily upon natural conditions, which, are quite uncertain. Nevertheless, the values have, in general, been more than unity in both the states during the entire study period. The rate of growth in TFP in this sector was computed to be 1.09, 0.32, and 0.56 percent in Bihar, Jharkhand, and the overall Indian economy, respectively (Table 7). Notably, the values of the TFP index were, in general, larger in the case of Bihar state in all the years (except during the early period of the second decade), thereby indicating that Bihar has fared better than Jharkhand state, as far as productivity in the primary sector is concerned. Over time, TFP in the primary sector has witnessed a sharp decline in both Bihar (*i.e.*, from 1.87 percent in pre-reform to 0.90 percent in the second decade of this century) and Jharkhand (*i.e.*, from 2.95 percent in the first decade to -1.20 in the second decade) states, but has witnessed a slight improvement (from 0.14 percent in the first decade to 0.48 in the second decade) in case of the Indian economy as a whole.

As gauged from productivity performance in the secondary sector, the picture has been rather depressing, particularly in the Bihar state. During the first decade of the study span, the TFP values for Jharkhand were better than those for the Bihar state. During the second decade, growth in TFP happened to be negative in both the states, thus indicating that the new economic policy induced an unfavorable effect on productivity performance in the secondary

sector of the states. During the last decade of the study span, the growth did pick up slowly in both states. During this decade, the TFP values for Bihar were, in general, less than one, thereby indicating the phase of technical retrogression. On the whole, the rate of TFP growth in Bihar was negative (equaling -0.84 percent), whereas the same in Jharkhand was 1.60 percent per annum. Thus, in comparative terms, the productivity performance in the secondary sector of Jharkhand was better than that of Bihar state. As far as the Indian economy is concerned, the pattern of TFP in the sector has been very erratic throughout the study period, with an overall rate of growth of just 0.62 percent per annum. Even the services sector of Bihar has undergone technical retrogression. During the entire study span, the TFP growth in aggregated Tertiary sector of Bihar was at a rate of (-)1.56 percent, against a rate of 1.95 percent in Jharkhand and 3.23 percent in India (Table 7). In comparative terms, the productivity performance of the Bihar state was far inferior in the Tertiary-1 sector; the TFP rate of growth in the sector was (-)1.31 percent as against a rate of 4.66 percent in Jharkhand and 3.18 percent in India. Similarly, concerning the TFP growth in the Tertiary-2 sector, the performance of the Bihar state (at a rate of -2.17 percent) was far more dismal compared to that of Jharkhand (at a rate of -0.03 percent) and the aggregated Indian economy (at a rate of 3.12 percent). At the aggregated level, TFP experienced changes in the Bihar state in a far more erratic manner (Table 4) *vis-à-vis* those in the Jharkhand state (Table 5), while the pattern was fairly consistent (and rising upwards) at the country level (Table 6). The overall rates of growth rate in TFP were computed to be 0.13, 2.46, and 2.47 percent per annum in Bihar, Jharkhand, and the Indian economy, respectively (Table 7).

We may thus say that at the aggregated level, the productivity performance of the Jharkhand state agreed with that at the country level, whereas the performance of the Bihar state, in comparative terms, was in shambles. Nevertheless, in both the states, all the sectors were observed to have experienced a deceleration in TFP growth during the second decade *vis-à-vis* the first decade, while at the country level, TFP growth showed an improvement in all the sectors (excepting Secondary and Tertiary-2).

5.3. Growth Accounting

An accounting of the average annual rate of growth in the domestic product is needed after having determined the year-to-year changes in TFP indexes and growth in factors of production and TFP (as measured through the translog index). In other words, our interest lay in making a decomposition of economic

growth into components associated with changes in factor inputs and the *Solow residual* (which reflects technological progress and other elements). Growth accounting analysis was done for each of the three economies and presented below for Bihar (Table 8), Jharkhand (Table 9), and India (Table 10).

In Bihar, the average annual rate of growth in real NSDP during the entire study span was at a rate of 4.6 percent per annum, of which the contribution of labor (60.2 percent) was much larger than that of capital (28.3 percent), thereby leaving a contribution of just about 11.5 percent attributable to TFP growth (Table 8). Labour has been the prime mover of growth in virtually all sectors (except for the primary sector, wherein labor could account for only 8.6 percent as against an accounting of 50.3 percent due to capital). Notably, the contribution due to TFP growth has drastically fallen from 42.8 percent during the first decade of this century to as bad as (-)4.4 percent during the second decade. The findings are a clear indication of the rather dismal performance of the Bihar economy on the productivity front. The primary sector was the lone sector which has portrayed a consistent picture of the contribution of TFP (40.1 percent during the first decade *versus* 42.2 percent during the second decade of this century). Unfortunately, the contributions due to TFP in the overall rate of growth have slipped during the successive spans rather sharply, not only in the secondary sector (from 30.0 to -18.3 percent) but in the services sector (from 5.8 to -34.9 percent) as well.

In Jharkhand also, labor has been the prime mover of NSDP growth in all the sectors (Table 9). But there existed a glaring point of difference! The contribution of TFP (equaling 47.6 percent) was more than four times that (equaling 11.5 percent) of Bihar. Although the contribution of TFP to the growth rate of output has temporally declined in all the sectors, yet, on the whole, the contributions in each of the sectors of Jharkhand state were, in general, larger than the corresponding contributions of Bihar state. As an exceptional case, the contribution of TFP to the rate of growth of output of the primary sector was substantially higher (at 41.2 percent) in Bihar as compared to that (11.1 percent) in Jharkhand.

As far as the productivity performance in aggregated Indian economy (having grown at a rate of 5.8 percent) is concerned, the contribution of labor (37.1 percent) was perceptibly larger than that of capital (20.1 percent). Notably, TFP (with a contribution of 42.8 percent) happened to be the prime mover of growth. However, the contribution of the source (*i.e.*, TFP) has come down marginally from 45.7 percent during the first decade to 41.8 percent

Table 4: Kendrick, Solow, and Translog (Divisia) Indexes of Total Factor Productivity – Bihar

Year	Primary				Secondary				Tertiary-1						
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.092	1.090	1.094	1.092	1.091	1.038	1.036	1.039	1.039	1.039	1.008	1.007	1.011	1.007	1.007
2004-05	1.140	1.136	1.145	1.139	1.137	0.992	0.986	0.997	1.001	1.015	0.984	0.983	0.990	0.983	0.983
2006-07	1.165	1.160	1.174	1.161	1.160	1.111	1.104	1.117	1.126	1.139	1.014	1.012	1.023	1.012	1.013
2008-09	1.192	1.183	1.204	1.183	1.182	1.133	1.123	1.142	1.182	1.197	0.998	0.996	1.011	0.997	0.998
2010-11	1.223	1.212	1.240	1.215	1.212	1.086	1.072	1.098	1.185	1.206	0.915	0.911	0.936	0.914	0.920
2012-13	1.268	1.253	1.290	1.266	1.263	0.988	0.974	1.000	1.094	1.124	0.878	0.875	0.894	0.872	0.881
2014-15	1.285	1.268	1.311	1.293	1.289	0.952	0.938	0.964	1.073	1.104	0.776	0.772	0.796	0.769	0.784
2016-17	1.328	1.310	1.357	1.347	1.342	0.818	0.803	0.830	0.960	1.004	0.796	0.792	0.816	0.789	0.803
2018-19	1.233	1.213	1.264	1.269	1.266	0.933	0.918	0.945	1.056	1.100	0.792	0.787	0.811	0.785	0.800
2020-21	1.302	1.280	1.338	1.365	1.360	0.876	0.863	0.886	0.953	1.001	0.798	0.794	0.818	0.792	0.807
Year	Tertiary-2				Tertiary				Aggregated Economy						
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	0.984	0.984	0.993	0.983	0.984	1.009	1.009	1.008	1.010	1.010	1.067	1.067	1.068	1.068	1.067
2004-05	0.980	0.980	0.995	0.980	0.980	1.011	1.012	1.009	1.013	1.013	1.101	1.100	1.105	1.102	1.100
2006-07	0.982	0.982	1.000	0.982	0.983	1.032	1.033	1.031	1.035	1.034	1.160	1.159	1.166	1.162	1.159
2008-09	0.987	0.987	1.006	0.987	0.988	1.036	1.037	1.035	1.039	1.038	1.197	1.194	1.209	1.200	1.196
2010-11	0.990	0.990	1.010	0.990	0.990	1.019	1.019	1.018	1.020	1.020	1.207	1.202	1.228	1.214	1.211
2012-13	0.903	0.903	0.926	0.897	0.904	0.950	0.951	0.948	0.949	0.953	1.207	1.202	1.233	1.218	1.215
2014-15	0.797	0.797	0.818	0.785	0.798	0.844	0.845	0.843	0.836	0.847	1.158	1.151	1.190	1.178	1.176
2016-17	0.782	0.782	0.806	0.770	0.783	0.846	0.847	0.844	0.836	0.848	1.147	1.138	1.186	1.181	1.180
2018-19	0.754	0.755	0.778	0.741	0.756	0.827	0.828	0.825	0.816	0.828	1.154	1.146	1.194	1.190	1.189
2020-21	0.711	0.711	0.733	0.695	0.712	0.799	0.800	0.798	0.787	0.801	1.150	1.142	1.191	1.188	1.187

Table 5: Kendrick, Solow, and Translog (Divisia) Indexes of Total Factor Productivity – Jharkhand

Year	Primary					Secondary					Tertiary-1				
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	0.997	0.997	0.997	0.997	0.997	1.074	1.076	1.073	1.078	1.081	1.219	1.219	1.217	1.224	1.219
2004-05	1.001	1.002	1.001	1.002	1.002	1.208	1.212	1.205	1.229	1.237	1.150	1.148	1.136	1.154	1.150
2006-07	1.056	1.056	1.056	1.056	1.056	1.529	1.536	1.523	1.583	1.602	1.368	1.359	1.337	1.377	1.368
2008-09	1.260	1.261	1.258	1.267	1.265	1.731	1.740	1.723	1.829	1.856	1.648	1.632	1.597	1.664	1.648
2010-11	1.359	1.362	1.356	1.372	1.369	1.910	1.922	1.900	2.068	2.102	1.827	1.797	1.747	1.848	1.827
2012-13	1.305	1.308	1.300	1.320	1.318	1.658	1.670	1.649	1.879	1.921	1.744	1.704	1.647	1.758	1.744
2014-15	1.344	1.348	1.338	1.362	1.360	1.694	1.708	1.684	1.996	2.043	1.752	1.695	1.626	1.761	1.752
2016-17	1.345	1.349	1.338	1.364	1.361	1.632	1.645	1.621	1.967	2.016	2.070	1.989	1.893	2.095	2.070
2018-19	1.174	1.177	1.168	1.184	1.188	1.576	1.589	1.566	1.923	1.975	2.040	1.950	1.846	2.061	2.040
2020-21	1.165	1.168	1.161	1.176	1.181	1.357	1.369	1.348	1.633	1.698	2.557	2.431	2.290	2.614	2.557
Year	Tertiary-2					Tertiary					Aggregated Economy				
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.017	1.017	1.022	1.018	1.017	1.101	1.101	1.100	1.106	1.101	1.088	1.091	1.078	1.093	1.095
2004-05	1.005	1.005	1.015	1.006	1.005	1.069	1.070	1.067	1.074	1.072	1.144	1.149	1.124	1.163	1.166
2006-07	1.021	1.021	1.033	1.022	1.021	1.153	1.155	1.15	1.165	1.159	1.311	1.318	1.280	1.355	1.361
2008-09	0.998	0.998	1.013	0.998	0.998	1.228	1.231	1.224	1.247	1.238	1.496	1.505	1.454	1.572	1.579
2010-11	1.084	1.084	1.105	1.090	1.085	1.339	1.343	1.334	1.368	1.353	1.644	1.656	1.592	1.758	1.767
2012-13	1.016	1.017	1.041	1.017	1.017	1.263	1.268	1.257	1.293	1.283	1.558	1.571	1.503	1.699	1.710
2014-15	0.953	0.954	0.979	0.950	0.955	1.211	1.217	1.205	1.239	1.235	1.591	1.605	1.530	1.762	1.774
2016-17	0.955	0.955	0.982	0.953	0.957	1.294	1.300	1.286	1.331	1.321	1.639	1.654	1.574	1.831	1.841
2018-19	0.974	0.974	1.004	0.973	0.976	1.292	1.299	1.283	1.331	1.321	1.585	1.600	1.522	1.774	1.787
2020-21	0.826	0.826	0.854	0.816	0.830	1.322	1.329	1.312	1.365	1.353	1.560	1.574	1.497	1.743	1.757

Table 6: Kendrick, Solow, and Translog (Divisia) Indexes of Total Factor Productivity – India

Year	Primary					Secondary					Tertiary-1				
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	0.990	0.989	0.991	0.988	0.989	1.007	1.006	1.008	1.007	1.007	1.051	1.051	1.050	1.053	1.051
2004-05	1.024	1.023	1.027	1.023	1.023	1.074	1.072	1.076	1.075	1.075	1.086	1.087	1.083	1.090	1.087
2006-07	0.977	0.975	0.981	0.972	0.974	1.094	1.091	1.097	1.098	1.097	1.165	1.166	1.161	1.172	1.166
2008-09	1.045	1.042	1.050	1.040	1.040	1.172	1.168	1.176	1.183	1.181	1.200	1.200	1.197	1.208	1.201
2010-11	1.049	1.046	1.056	1.043	1.042	1.269	1.262	1.274	1.289	1.284	1.247	1.247	1.248	1.258	1.248
2012-13	1.049	1.045	1.056	1.042	1.042	1.151	1.145	1.156	1.164	1.166	1.228	1.228	1.230	1.237	1.229
2014-15	1.085	1.079	1.093	1.079	1.078	1.198	1.192	1.204	1.216	1.215	1.318	1.317	1.321	1.333	1.319
2016-17	1.137	1.131	1.146	1.132	1.130	1.266	1.258	1.272	1.294	1.289	1.482	1.480	1.488	1.509	1.485
2018-19	1.148	1.143	1.157	1.143	1.141	1.169	1.160	1.175	1.194	1.196	1.577	1.576	1.584	1.611	1.581
2020-21	1.132	1.126	1.141	1.129	1.126	1.152	1.144	1.158	1.176	1.179	1.649	1.646	1.661	1.696	1.660
Year	Tertiary-2					Tertiary					Aggregated Economy				
	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI	KI1	KI2	KI3	SI	TLI
2000-01	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2002-03	1.057	1.057	1.058	1.059	1.057	1.055	1.056	1.055	1.058	1.056	1.027	1.027	1.029	1.027	1.027
2004-05	1.121	1.121	1.125	1.127	1.121	1.107	1.108	1.107	1.112	1.108	1.085	1.085	1.089	1.087	1.085
2006-07	1.222	1.222	1.227	1.232	1.222	1.201	1.201	1.200	1.210	1.202	1.114	1.113	1.120	1.116	1.113
2008-09	1.312	1.312	1.319	1.327	1.312	1.271	1.272	1.270	1.284	1.273	1.196	1.194	1.205	1.200	1.194
2010-11	1.429	1.429	1.437	1.450	1.429	1.364	1.365	1.363	1.382	1.366	1.264	1.261	1.277	1.272	1.264
2012-13	1.482	1.482	1.491	1.506	1.482	1.387	1.388	1.386	1.406	1.388	1.263	1.259	1.279	1.271	1.264
2014-15	1.512	1.512	1.521	1.538	1.512	1.447	1.448	1.446	1.470	1.449	1.331	1.327	1.351	1.346	1.335
2016-17	1.606	1.606	1.616	1.638	1.607	1.578	1.579	1.577	1.609	1.580	1.437	1.432	1.463	1.463	1.448
2018-19	1.774	1.775	1.784	1.816	1.774	1.713	1.714	1.712	1.754	1.717	1.484	1.477	1.516	1.522	1.504
2020-21	1.879	1.879	1.885	1.927	1.878	1.805	1.805	1.805	1.856	1.812	1.525	1.517	1.562	1.578	1.556

Table 7: Estimates of Average Annual Growth Rates in Total Factor Productivity in Major Sectors of Bihar, Jharkhand, and India

Sector	Index	Bihar					Jharkhand					India				
		2000-2001	2005-06	2010-11	2015-16	2020-2021	2000-2001	2005-06	2010-11	2015-16	2020-2021	2000-2001	2005-06	2010-11	2015-16	2020-2021
PRM	KI	1.88	0.20	0.61	0.19	0.62	2.90	-1.52	-0.17	-1.25	0.26	0.17	1.16	-0.74	0.29	0.47
	SI	1.89	0.80	1.27	0.90	1.10	2.97	-1.54	-0.15	-1.26	0.29	0.13	1.22	-0.25	0.49	0.57
	TLI	1.87	0.79	1.27	0.90	1.09	2.95	-1.48	-0.13	-1.20	0.32	0.14	1.19	-0.23	0.48	0.56
SEC	KI	0.83	-1.87	0.28	-1.26	-1.28	7.20	-2.65	1.47	-0.99	0.74	2.18	-0.41	1.10	-0.06	0.43
	SI	1.72	-1.70	0.27	-1.79	-1.07	8.03	-1.58	1.22	-0.68	1.48	2.39	-0.28	1.67	0.17	0.63
	TLI	1.90	-1.41	0.24	-1.59	-0.84	8.22	-1.40	1.13	-0.61	1.60	2.35	-0.25	1.56	0.16	0.62
TR1	KI	-0.58	-1.34	-1.01	-0.79	-1.26	5.65	2.74	5.66	4.79	4.36	2.31	3.52	4.01	3.74	2.99
	SI	-0.56	-1.37	-0.75	-0.68	-1.22	5.94	3.19	6.17	5.29	4.79	2.40	3.76	5.03	4.29	3.32
	TLI	-0.51	-1.27	-0.68	-0.63	-1.13	5.83	3.10	5.99	5.11	4.66	2.32	3.59	4.81	4.10	3.18
TR2	KI	0.08	-2.91	-1.65	-2.75	-2.24	0.41	-2.38	4.36	0.32	-0.08	3.81	2.94	4.06	3.11	3.16
	SI	0.09	-3.09	-1.41	-2.80	-2.32	0.44	-2.53	4.83	0.40	-0.05	3.97	3.05	4.01	3.15	3.25
	TLI	0.09	-2.89	-1.31	-2.61	-2.17	0.41	-2.35	4.53	0.40	-0.03	3.81	2.93	3.86	3.03	3.12
TRT	KI	0.39	-2.14	-1.07	-1.79	-1.56	2.60	-0.16	4.93	2.32	1.85	3.28	3.22	4.34	3.49	3.20
	SI	0.41	-2.31	-1.16	-1.92	-1.67	2.78	-0.10	5.42	2.56	2.04	3.41	3.38	4.67	3.73	3.39
	TLI	0.40	-2.16	-1.08	-1.79	-1.56	2.68	-0.06	5.08	2.42	1.95	3.29	3.24	4.48	3.58	3.28
AGG	KI	1.96	-0.55	-0.28	-0.65	-0.10	5.09	-0.35	3.56	1.32	2.06	2.25	2.29	2.57	2.20	2.16
	SI	2.05	-0.22	0.05	-0.43	0.11	5.76	0.06	3.58	1.48	2.47	2.32	2.63	3.64	2.82	2.56
	TLI	2.01	-0.20	0.03	-0.40	0.13	5.82	0.09	3.38	1.42	2.46	2.26	2.54	3.51	2.72	2.47

Table 8: Growth Accounting in respect of Major Sectors during Different Time Spans – Bihar

<i>Time-Period</i>	<i>Av. Annual Growth Rate (%) in</i>	<i>Primary</i>	<i>Secondary</i>	<i>Tertiary-1</i>	<i>Tertiary-2</i>	<i>Tertiary</i>	<i>Aggregated Economy</i>
2000 – 01 to 2010 - 11	Labour	0.50 (10.44)	1.35 (21.63)	1.97 (62.71)	3.66 (102.85)	2.83 (82.8)	1.25 (28.0)
	Capital	2.37 (49.43)	3.03 (48.40)	2.00 (63.64)	-0.01 (-0.04)	0.39 (11.37)	1.30 (29.18)
	TFI	2.87 (59.87)	4.38 (70.03)	3.99 (126.35)	3.66 (102.81)	3.22 (94.17)	2.55 (57.18)
	TFP	1.92 (40.13)	1.88 (29.97)	-0.83 (-26.35)	-0.10 (-2.81)	0.20 (5.83)	1.91 (42.82)
	NSDP	4.79 (100.00)	6.26 (100.00)	3.15 (100.00)	3.56 (100.00)	3.42 (100.00)	4.47 (100.00)
2011 – 12 to 2020 -21	Labour	0.17 (6.70)	6.35 (92.69)	5.10 (84.52)	6.56 (150.57)	6.03 (120.77)	3.54 (76.53)
	Capital	1.30 (51.12)	1.75 (25.57)	1.93 (31.97)	0.09 (2.04)	0.70 (14.09)	1.29 (27.86)
	TFI	1.47 (57.82)	8.10 (118.26)	7.03 (116.49)	6.65 (152.61)	6.74 (134.86)	4.83 (104.38)
	TFP	1.07 (42.18)	-1.25 (-18.26)	-1.00 (-16.49)	-2.29 (-52.61)	-1.74 (-34.86)	-0.20 (-4.38)
	NSDP	2.53 (100.00)	6.85 (100.00)	6.04 (100.00)	4.36 (100.00)	5.00 (100.00)	4.63 (100.00)
2000 01 to 2020 - 21	Labour	0.28 (8.57)	4.63 (69.61)	4.02 (79.82)	5.56 (136.22)	4.93 (110.72)	2.75 (60.19)
	Capital	1.67 (50.28)	2.19 (32.99)	1.96 (38.79)	0.06 (1.42)	0.60 (13.37)	1.29 (28.30)
	TFI	1.95 (58.85)	6.82 (102.60)	5.98 (118.61)	5.62 (137.64)	5.52 (124.09)	4.05 (88.49)
	TFP	1.36 (41.15)	-0.17 (-2.60)	-0.94 (-18.61)	-1.54 (-37.64)	-1.07 (-24.09)	0.53 (11.51)
	NSDP	3.31 (100.00)	6.64 (100.00)	5.04 (100.00)	4.08 (100.00)	4.45 (100.00)	4.57 (100.00)

during the second decade of this century (Table 10). Over the two time spans, the Secondary sector has witnessed the biggest loss (from 46.2 to -0.3 percent) in productivity, followed next by the Primary sector (from 15.1 to 3.7 percent). The performance of the services sector (aggregated as well as disaggregated) has remained fairly consistent.

Table 9: Growth Accounting in respect of Major Sectors during Different Time Spans – Jharkhand

<i>Time-Period</i>	<i>Av. Annual Growth Rate (%) in</i>	<i>Primary</i>	<i>Secondary</i>	<i>Tertiary-1</i>	<i>Tertiary-2</i>	<i>Tertiary</i>	<i>Aggregated Economy</i>
2000-01 to 2010-11	Labour	0.85 (19.31)	0.74 (12.2)	2.28 (27.88)	5.44 (86.90)	3.88 (55.16)	1.64 (28.69)
	Capital	0.41 (9.39)	-2.13 (-35.26)	-0.12 (-1.51)	0.01 (0.09)	0.13 (1.82)	-1.61 (-28.11)
	TFI	1.27 (28.70)	-1.39 (-23.06)	2.16 (26.37)	5.44 (86.99)	4.00 (56.98)	0.03 (0.58)
	TFP	3.14 (71.30)	7.43 (123.06)	6.03 (73.63)	0.81 (13.01)	3.02 (43.02)	5.69 (99.42)
	NSDP	4.41 (100.00)	6.04 (100.00)	8.18 (100.00)	6.26 (100.00)	7.03 (100.00)	5.72 (100.00)
2011-12 to 2020-21	Labour	2.09 (91.54)	5.87 (95.36)	5.18 (50.03)	6.66 (90.12)	6.12 (69.22)	4.13 (64.84)
	Capital	1.34 (58.63)	0.89 (14.44)	0.54 (5.20)	0.18 (2.40)	0.41 (4.64)	0.77 (12.15)
	TFI	3.42 (150.17)	6.75 (109.80)	5.72 (55.23)	6.83 (92.52)	6.53 (73.86)	4.90 (76.99)
	TFP	-1.14 (-50.17)	-0.60 (-9.80)	4.63 (44.77)	0.55 (7.48)	2.31 (26.14)	1.46 (23.01)
	NSDP	2.28 (100.00)	6.15 (100.00)	10.35 (100.00)	7.39 (100.00)	8.85 (100.00)	6.39 (100.00)
2000 – 01 to 2020-21	Labour	1.66 (55.10)	4.10 (67.04)	4.18 (43.52)	6.23 (89.12)	5.35 (65.07)	3.27 (53.22)
	Capital	1.02 (33.79)	-0.15 (-2.49)	0.31 (3.23)	0.12 (1.69)	0.31 (3.81)	-0.05 (-0.79)
	TFI	2.68 (88.89)	3.94 (64.55)	4.49 (46.75)	6.35 (90.81)	5.66 (68.88)	3.22 (52.43)
	TFP	0.33 (11.11)	2.17 (35.45)	5.11 (53.25)	0.64 (9.19)	2.56 (31.12)	2.92 (47.57)
	NSDP	3.01 (100.00)	6.11 (100.00)	9.6 (100.00)	7.00 (100.00)	8.22 (100.00)	6.14 (100.00)

Table 10: Growth Accounting in respect of Major Sectors during Different Time Spans – India

<i>Time-Period</i>	<i>Av. Annual Growth Rate (%) in</i>	<i>Primary</i>	<i>Secondary</i>	<i>Tertiary-1</i>	<i>Tertiary-2</i>	<i>Tertiary</i>	<i>Aggregated Economy</i>
2000 – 01 to 2010 -11	Labour	1.09 (31.43)	1.38 (24.56)	2.37 (40.43)	4.08 (52.28)	3.26 (46.92)	1.74 (32.80)
	Capital	1.82 (53.50)	1.57 (29.25)	1.20 (20.58)	0.01 (0.15)	0.46 (6.61)	1.12 (21.46)
	TFI	2.90 (84.93)	2.95 (53.81)	3.57 (61.01)	4.10 (52.43)	3.72 (53.53)	2.86 (54.26)
	TFP	0.42 (15.07)	2.50 (46.19)	2.22 (38.99)	3.57 (47.57)	3.12 (46.47)	2.34 (45.74)
	NDP	3.32 (100.00)	5.45 (100.00)	5.78 (100.00)	7.66 (100.00)	6.84 (100.00)	5.20 (100.00)
2011-12 to 2020- 21	Labour	1.09 (43.28)	4.66 (75.00)	3.23 (37.78)	3.94 (53.36)	3.73 (47.13)	2.39 (38.73)
	Capital	1.33 (53.05)	1.57 (25.26)	1.72 (20.08)	0.26 (3.45)	0.71 (8.99)	1.20 (19.42)
	TFI	2.42 (96.33)	6.24 (100.26)	4.95 (57.86)	4.20 (56.81)	4.44 (56.12)	3.59 (58.15)
	TFP	0.09 (3.67)	-0.02 (-0.26)	3.60 (42.14)	3.19 (43.19)	3.47 (43.88)	2.58 (41.85)
	NDP	2.51 (100.00)	6.22 (100.00)	8.56 (100.00)	7.39 (100.00)	7.91 (100.00)	6.17 (100.00)
2000 – 01to 2020- 21	Labour	1.09 (38.95)	3.53 (59.30)	2.93 (38.62)	3.99 (53.33)	3.57 (47.3)	2.17 (37.1)
	Capital	1.50 (53.75)	1.57 (26.40)	1.54 (20.25)	0.17 (2.28)	0.62 (8.28)	1.17 (20.09)
	TFI	2.59 (92.70)	5.10 (85.70)	4.47 (58.87)	4.16 (55.61)	4.19 (55.58)	3.34 (57.19)
	TFP	0.20 (7.30)	0.85 (14.30)	3.13 (41.13)	3.32 (44.39)	3.35 (44.42)	2.50 (42.81)
	NDP	2.79 (100.00)	5.95 (100.00)	7.60 (100.00)	7.48 (100.00)	7.54 (100.00)	5.84 (100.00)

In a nutshell, TFP was the main contributor to output growth of both the states during the first decade, whereas the slot got occupied by the labor force during the second decade. However, in the overall Indian economy, TFP has continued to remain the prime source of economic growth during the entire study span.

6. CONCLUSIONS AND POLICY IMPLICATIONS

This paper tries to analytically gauge the contribution of total factor productivity to output expansion in major sectors of the neighboring developing states of Bihar and Jharkhand *vis-à-vis* the overall Indian economy. The performance of Jharkhand has been perceptibly superior to that of Bihar as per the main finding of the TFP analysis. Nevertheless, all the sectors in each of the two states have undergone a temporal deceleration in TFP growth, thereby pointing toward the ineffectiveness of economic reform measures to induce technical progress in the states. However, in the overall Indian economy, various sectors (except Secondary and Tertiary-2) experienced productivity improvement over time. Further, TFP contributed the most to output growth of both the states during the first decade (2000-01 to 2010-11), while labor acted as a prime mover during the second decade (2011-12 to 2020-21). Whereas, on the other hand, it was the TFP growth that acted as the major source of economic growth in the aggregated Indian economy during the entire study span. The findings, thus, signify that although liberalization policies have shown desirable results at the aggregated level, there has been a considerable variation in the speed and extent of implementation of the reform measures across the states. Therefore, for the states (particularly Bihar) to surge ahead, it is imperative to address regional problems to enhance TFP, which has become virtually synonymous with economic growth. The provision of better health infrastructure, and increased skill formation activities *via* education and training programs might help in this direction.

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