

# Structural Changes in Indian Economy: An Empirical Analysis using Input-Output Structural Decomposition Analysis

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## Abstract

The present study is an attempt to decompose the changes in output growth in India since 1983-84. For analysis purpose, study has bifurcated the whole period into two parts i.e. pre (1983-84 to 1993-94) and post (1993-94 to 2006-07) reforms period. Input-Output tables for the year 1983-84, 1993-94 and 2006-07 have been utilized for this purpose. Due to non-availability of recent Input-Output table, the analysis of the recent years (2007-08 to 2012-13) has been done using the data from different Economic Surveys provided by the Ministry of Finance, Government of India. The study utilized structural decomposition analysis to categorize the different sources of output growth. While comparing the two study periods, results show that for the primary sector (1 to 11) there is rise in private consumption and government consumption expenditure. However, percentage share of exports and investment expenditure in primary sector have declined over two periods. In secondary sector (12 to 44), there is a sharp increase in percentage share of all demand categories. For tertiary sector (45 to 58), the increase has been shown in investment expenditure, imports and exports only. Further, it is the average growth of final demand which holds the largest share in change of output growth over the study period. Among the five categories of final demand, domestic demand (sum of private consumption, government consumption and investment expenditure) is the dominant source of output growth in both the periods. It shows that Indian economy has a very strong domestic market.

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*Index terms*— structural changes, input-output analysis, structural decomposition analysis, output growth.

## 1 I. Introduction

conomic development and structural changes are highly associated with each other. Economic development is defined as a process of combining economic growth with changing share of different sectors in the national product and labor force. Structural changes do not only characterize economic development, these are also necessary for sustaining the economic growth. The common structural changes in most of the developing economies are observed by changing structure from agriculture sector to manufacturing sector and then followed by services sector. Structural changes in an economy can be studied in respect of different outcomes like changes in output, employment, capital investment and consumption among others. The underdeveloped countries have dominant share of agricultural sector with rising share of manufacturing and services sectors. Due to rise in levels of income, the demand for agricultural products declines and that for industrial goods increases and after reaching a reasonably high level of income, demand for services increases sharply. It is found that the growing demand for services has contributed the largest share in GDP from the last two decades. Larger population have shifted to the urban areas from rural areas which raised the demand for transport and trade services to provide food to the urban people from rural areas. Construction activities are expanding day by day due to demand of housing

42 related services which are generally not common in villages (Papola, 2005). Over the last six decades, the share  
43 of agriculture has continuously declined from 57 percent in 1950-51 to 40 percent in 1980-81 to 24 percent in  
44 1995-96, to about 16 percent in 2009-10. Industry and services have both increased their share, but at different  
45 pace and in different periods.

46 In the present paper, structure of changing output since 1983-84 till 2012-13 has been analyzed by using Indian  
47 input/output tables. On the basis of economic reforms, which took place in 1991, the study divided the economy  
48 into two phases viz, the prereforms phase and the post reforms phase. The paper tried to explain the different  
49 sources of output growth over the study period. For this purpose, Input-Output structural decomposition analysis  
50 has been utilized. Dhawan (1993) and Saxena et al. (2013) have also used the same approach to evaluate the  
51 sources of output growth in post-liberalized era in Indian economy. It is the modified version of ?orsell (1988)  
52 methodology of calculating the sources of output growth by adding the interaction term (in between final demand  
53 change and technology change).

54 To present the complete analysis, whole study has been divided into five sections including the present  
55 introductory one. In Section 2, changing production structure of the Indian economy, has been presented and  
56 discussed. By using the same sector aggregation (see Appendix Table A1 for details), changing structure of Indian  
57 economy has been explained by calculating sector-wise average annual growth rates. Section 3 explains about  
58 the sources of database utilized and applied methodology used for the empirical analysis. In Section 4, empirical  
59 results have been presented and Section 5 concludes the whole study and provides some policy implications  
60 inherited from the analysis.

## 61 2 II. Production Structure of Indian Economy

62 Production structure of the Indian economy has been explained by using the percentage share of each sector's  
63 output in total output of the economy. Table 1 reports the production structure of the Indian economy over  
64 the study period. It also presents the average annual growth rate of output over two periods. The following  
65 two subsections explain in detail the changing production structure of Indian economy for pre-and post-reforms  
66 period.

### 67 3 a) From 1983-84 to 1993-94

68 It directly depict from Table 1 that the share of Food Crops (1) fell from 9.86 % to 6.80 %. The agricultural  
69 output for the year 1992-93, has declined due to erratic behavior of south-west monsoon. That is why the share  
70 of agriculture in GDP declines. In the next year, 1993-94, monsoon showed its normal behavior and it tried to  
71 compensate for the last year, so the difference is not much large in production and stability maintained in most  
72 of the other farm products. Further, the share of Cash Crops (2), Plantation Crops (3), Other Crops (4), Animal  
73 Husbandry (5) and Forestry & Logging (6) also show a decline in their shares in total output over the study  
74 period. In contrast, the share of Fishing (7) and Coal & Lignite (8) have gone up, there is no change in Iron Ore  
75 (10) and Other Minerals (11) with a little difference which is no significant except Crude Petroleum & Natural  
76 Gas (9) which showed decline. On account of the fall in the shares of most of the sectors, the share of primary  
77 sector (sector 1 to 11) to GDP has declined from 28.44 percent to 23.34 percent.

78 There is some deceleration in industrial sector growth in the year 1983-84, it reflects sluggishness in output in  
79 several industries. Power situation in some parts of the country has been adversely affected by the droughts in  
80 1982-83. If we compare the figures of output structure of manufacturing sector in 1993-94 with that of 1983-84  
81 then it shows the signs of resurgence. According to the estimates of Economic Survey 1993-94, industrial growth  
82 was below expectations due to the Ayodhya incidents which disrupted industrial activity and had upset business  
83 plans and investment decisions since December 1993. Even increase some shares of different industrial sectors,  
84 the share of secondary sector (sector 12 to 44) has reduced from 31.89 to 30.53 percent in total output of the  
85 economy.

### 86 4 b) From 1993-94 to 2006-07

87 For the years, 1993-94 to 2006-07, the results show that the share of Food Crops (1) fell from 6.8 % to 4.1%. The  
88 agricultural output for the year 2006-07, has declined due to deficiency/variability in rainfall during that year.  
89 Due to this deficiency of rainfall, the share of agriculture in GDP declines. It also creates inflationary pressure  
90 in the economy and dampens the other sectors' growth via demand reduction (Economic Survey, 2006-07). The  
91 share of Cash Crops (2), Other Crops (4), Animal Husbandry (5), Forestry & Logging (6), Fishing (7), Coal &  
92 Lignite (8) are showing a decline in their shares in total output over the study period. In contrast, the share of  
93 Plantation Crops (3), Crude Petroleum & Natural Gas (9), Iron Ore (10) and Other Minerals (11) which show a  
94 rise in the total output of the Indian Economy. So, fall in the shares of most of the sectors, the share of primary  
95 sector (sector 1 to 11) to GDP has declined from 23.34 percent to 14.46 percent. There is some boost in industrial  
96 sector growth in the year 2006-07, it shows the impressive growth of the industrial sector, propelled by robust  
97 growth in manufacturing has continued unabated, but there is some deceleration of growth in consumer goods  
98 industries ??

## 5 b) Methodology Used

The methodology applied in this paper is just an extension of the standard Leontief Input-Output formula given as: According to this formula, the change in output (X) over the period may be due to change in final demand (F) or due to the change in technological relations or due to change in both (the interaction component in this study takes care of this change). Where X is the output vector, A is the technological coefficient matrix and F is the final demand vector. In the present study, following Forsell (1988), final demand vector has been further bifurcated into five demand categories viz, private consumption expenditure (P), government consumption expenditure (G), gross investment (I), exports (X) and imports (I). In addition to this, following Saxena et al. (2013), the same methodology of calculating the sources of output growth has been further modified by adding the interaction term effect. Following subsections will explain all four components in detail.

## 6 c) 1 Sources of Output Growth

By using Leontief's formula, the value of output in the given year can be written as follows: 
$$X = (I - A)^{-1} F$$
 (1)

As per the structural decomposition analysis, the total growth in output has been divided into four major components and each component is composed of five more components, such as the growth of private consumption; the growth of government consumption; the growth of gross investment; the growth of exports and the growth of imports. The first four of these effects have positive sign and the last effect has a negative sign because imports are a substitute for domestic output as another source of supply. Any growth of imports is evaluated as if it had been a loss to the domestic production. If the growth effect of imports is large enough or the initial amount of imported products is greater than output, the total growth effect may even be negative (Forsell, 1988).

The first component i.e., effect of average growth of final demand are analyzed in order to reveal how much output in each industry would have changed if all elements of a particular final demand category were growing at the same rate. One can use this component for comparison purpose only in case of aggregate change in final demand (i.e., not suitable for comparison in case of further disaggregation of final demand category). Guill (1979) explains that this component is equivalent to the difference of final expenditure in period t and period zero. One can calculate the extent of this component by estimating the following equation: 
$$\Delta X = \sum_{i=1}^n \Delta F_i \cdot (I - A)^{-1} \cdot L_i$$
 (2)

where  $\Delta X$  represents the change in output; L shows the different demand categories such as private consumption expenditure, government expenditure, gross Investment, exports and imports; Subscript 0 represents the values pertaining to the initial year and  $\Delta F_i$  is the average growth rate of different demand categories between the initial and the final year respectively, and can be calculated as:

where i refers to sector number and stands for the average rate of private consumption expenditure between the initial year and the terminal year (t). The above formula represents the average growth rate of private consumption expenditure over the years. One can also calculate the average growth rates for other demand categories as well by using the same formula.

The second component of change in final demand i.e., changes in the composition of final demand refer to the difference between the actual sectoral final demand element and the sectoral final demand element calculated according to the average growth rate of the related final demand category. Guill (1979) measures this component by subtracting that vector of final demand of year t which is constructed by distributing total final demand of year t according to the industrial composition of final demand in year zero from the actual final demand vector of year t. The effects of change in the composition of final demand category is analyzed in order to find out how much deviations of actual growth of sectors from average growth of a particular final demand category have caused structural changes in industrial output. These changes are exogenous to the production system under consideration. Thus, the first effect tells us what would have happened to industrial output if all final demand elements were growing at the average growth rate whereas the second component explains what actually happened since in actuality all final demand elements do not grow at the average growth rate. Both effects assumed that technology remains constant. Following is the formula to calculate the proportion of this component in total change in final demand over the study period.

$$\frac{\sum_{i=1}^n \Delta F_i \cdot (I - A)^{-1} \cdot L_i}{\Delta X} \quad (3)$$

Further, the third component of output change measures the effect of change in technology on output keeping final demand as constant. In other words, the estimation of this effect reveals how much output in each industry has changed due to change in the inputoutput coefficients. It can be estimated by subtracting Leontief inverse matrix of initial period from inverse of terminal year and then multiplied with final demand vector of initial period. Mathematically, it can be written as follows:

$$(I - A_t)^{-1} - (I - A_0)^{-1} \cdot F_0 \quad (4)$$

The

$$\frac{\sum_{i=1}^n \Delta F_i \cdot (I - A_t)^{-1} - (I - A_0)^{-1} \cdot F_0}{\Delta X} \quad (5)$$

## 8 Contribution of Different Final Demand Categories

One can also measure the contribution of separate demand factors like private consumption, government consumption, gross investment, exports and imports to output growth between the initial and the final year. Following expression is used to calculate the contribution of private consumption expenditure in output change between two periods: where subscripts 1 to 4 shows the proportion of its changes from all four sources of output growth mentioned in previous sub-section.

These identities will be used to measure the total individual effect of a final demand category on the total output change. It separates certain components and in this way it helps us to understand better that what has happened in the economy. Thus, the change in output is the result of four different effects and the sum total of values of all the effects should be equal to the total change in output.

## 9 IV.

## 10 Empirical Analysis

This section presents the empirical results pertaining to the percentage share of each category in the total change in output during the pre reform period (i.e. 1983-84 to 1993-94) and post reform period (i.e. 1993-94 to 2006-07). In addition to this, percentage share of each demand category has also been calculated in the same section.

## 11 a) Sources of Output Growth

Table 2 presents the percentage contribution of four sources of output growth mentioned in the previous section. For analyzing pre-reforms period, 1983-84 has taken as initial year and 1993-94 as final year and for post-reforms period, 1993-94 becomes the initial year and 2006-07 taken as terminal year. During pre-reforms period, the first component, i.e. the average growth of final demand contributes 120.15 percent. In other words, if the distribution of final demand had not changed between 1983-84 to 1993-94 and neither the interindustry relations; total output on an average, would have increased by 120.15 percent from its initial level of 1983-84 period.

Moreover, for the post-reforms period, the average growth of final demand component contributes 114.37 percent. In other words, if the distribution of final demand had not changed between 1993-94 to 2006-07 and neither the inter-industry relations; total output would have increased by 114.37 percent of its initial level of 1993-94 period. On an aggregate, the results show that changes in final demand for both the periods are more significant in its effect on production levels in comparison to the effect of other components.

In the first component, we have assumed the constant average growth rate of each sector over the study period with same inter-industry relations. The second component of output change are analyzed in order to find out the deviations of actual growth rate of particular sector from the average growth of that sector which we have assumed in the first component. This component shows the structural change in industrial output. The sum of these two components of output growth shows the net impact of actual final demand change on output change over the study period. For both the periods, the contribution of this factor into the change in final demand is negative. Negative effect indicates that changes in composition reduce the production in these sectors. In addition, negative sign also reduces the net effect of final demand change on output change.

Sector-wise analysis show that during prereforms period, among the 58 sectors, 22 sectors have negative effect on total output change which shows that these sectors are growing at less rate than average growth rate assumed constant for all the sectors. The sectors with negative effect are Food Crops (1), Cash Crops (2), Animal Husbandry (5) The positive effect of all these sectors depicts that the actual growth rate of these sectors is higher than the average growth rate shows the structural change in these sectors. These sectors show the significant increase in production during pre-reforms period due to compositional change.

Similarly, during post-reforms period, The sectors with negative effect (total 28) are Other Crops (4), Fishing (7) Further, on an aggregate, the effects of third component i.e., technical change over the study period led to decrease in output by -5.61percent of the initial output level of 1983-84. On the contrary, during postreforms era, the same effect leads to the positive change in output by 5.61 percent of the initial output level of 1993-94. This positive impact indicate the structural changes in the production system because here in this component we have used the actual inputoutput relations for both the periods by assuming final demand as constant.

Finally, the fourth component of output change which measures the differential effect of final demand change due to technological change on industrial output, contributes about -5.61 percent in total output change during pre-reforms era and 3.03 percent during post-reforms period. b) Contribution of Final Demand Categories Table 3 presents the percentage contribution of different final demand categories in output growth over the study period. The results depict that in both the periods, the major portion of the output growth comes from the private consumption (91.32 and 92.63 percent) followed by imports (32.40 and 78.13 percent) and exports (32.08 and 61.77 percent). While the contribution of government expenditure (17.89 and 13.48 percent) and investment expenditure (-8.88 and 10.25 percent) are far less. During pre-reforms period, the contribution of investment expenditure was negative but after 1993-94, it played a major role to shape the economy from its indigenous look to the modern look. It may be due to the policy of de-licensing and attractive foreign investment policy environment in the country.

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216 Sector-wise analysis shows that during prereforms period, sectors in which output grew mostly because of  
217 increases in final consumption expenditure by private households are Food Crops (1), Cash Crops (2), Plantation  
218 Crops (3), Other Crops (4), Animal Husbandry (5), Forestry & Logging (6), Fishing (7) . During our study  
219 period, it directly depicts that the important contribution to demand had come from private consumption and  
220 followed by imports and exports. There is now no doubt that the economy has moved to a higher growth plane,  
221 with growth in GDP at market prices exceeding 8 per cent in every year since 2003-04. The projected economic  
222 growth of 8.7 per cent for 2007-08 is fully in line with this trend. There was acceleration in domestic investment  
223 and saving rates to drive growth and provide the resources for meeting the 9 per cent (average) growth target  
224 of the Eleventh Five-Year Plan. Macroeconomic fundamentals continue to inspire confidence and the investment  
225 climate is full of optimism (Economic Survey, 2007-08).

226 Despite the slowdown in the growth, investment remained relatively buoyant and growing at a rate higher  
227 than that of GDP. A decline in all major elements of private demand, including exports and consumption  
228 leads to deceleration of economic growth to 6.7 percent in 2008-09. The major reason behind the slowdown in  
229 Indian economy was global financial meltdown and recession in developed countries. Every developing country  
230 suffered to some extent from this global economic shock (Economic Survey, 2008-09). The contribution of private  
231 consumption to aggregate growth declined dramatically from 53.8 per cent in 2007-08 to 27 per cent in 2008-09.  
232 The reason behind was the financial crisis that began in 2007 in U.S. and spread all over the world and its negative  
233 impact remains till 2009-10. The crisis had its direct as well as indirect implications for the whole world due to  
234 economic integration. It had its impact on India through reduction in demand for exports and hence the loss  
235 of earnings to India, increased unemployment, tighter restrictions on credit by banks which reduces investment  
236 and mainly through loss of confidence of investor in the economy. Hence, the share of investment reduces with  
237 increase in share of consumption expenditure. While explaining the consumption expenditure it should be noted  
238 that due to crisis private consumption expenditure reduces, shown by decline in aggregate growth rate from  
239 53.8 per cent in 2007-08 to 27 per cent in 2008-09 but this reduction in PFCE was compensated by increased  
240 government consumption expenditure from a level of 8 per cent in 2007-08 to a level of 32.5 per cent in 2008-09  
241 to boost up the economy.

242 In 2009-10, the economy has shown the sign of recovery with increased growth in manufacturing sector,  
243 which had seen continuous decline in the growth rate since 2007-08, rate of fixed capital formation, a proxy for  
244 investment in the economy and turnaround in the merchandise exports in December 2009-10 (Economic Survey,  
245 2009-10). The economy grew at the rate of 8.4 percent during the years 2009-10 and 2010-11 and the savings  
246 and investment rates had begun rising once again. After global meltdown, while tightening the monetary policy,  
247 in particular raising the repo rate in order to control inflation, resulted in some slowing down of investment and  
248 growth. The revisions indicate that the global crisis in 2008-09 was mainly reflected in negative growth in gross  
249 capital formation, with the slowdown in private final consumption expenditure being modest.

250 The growth in real terms of consumption expenditure, gross fixed capital formation, exports and imports  
251 works out to 6 percent, 5.6 percent, 14.3 percent and 17.5 percent respectively for the year 2011-12. The rate  
252 of growth of private final consumption expenditure in real terms has been fairly consistent and did not decline  
253 significantly even when the growth rate was relatively lower (Economic Survey, 2011-12).

254 V.

## 255 12 Conclusion

256 The present study is an attempt to decompose the changes in output growth in India since 1983-84. For analysis  
257 purpose, study has bifurcated the whole period into two parts i.e. pre (1983-84 to 1993-94) and post (1993-94  
258 to 2006-07) reforms period. Input-Output tables for the year 1983-84, 1993-94 and 2006-07 have been utilized  
259 for this purpose. Due to non-availability of recent Input-Output table, the analysis of the recent years (2007-08  
260 to 2012-13) has been done using the data from different Economic Surveys provided by the Ministry of Finance,  
261 Government of India. The study utilized structural decomposition analysis to categorize the different sources of  
262 output growth.

263 While comparing the two study periods, results show that for the primary sector (1 to 11) there is rise in  
264 private consumption and government consumption Volume XIV Issue I Version I 74 ( E ) expenditure. However,  
265 percentage share of exports and investment expenditure in primary sector have declined over two periods. In  
266 secondary sector (12 to 44), there is a sharp increase in percentage share of all demand categories. For tertiary  
267 sector (45 to 58), the increase has been shown in investment expenditure, imports and exports only. Further, it  
268 is the average growth of final demand which holds the largest share in change of output growth over the study  
269 period. Among the five categories of final demand, domestic demand (sum of private consumption, government  
270 consumption and investment expenditure) is the dominant source of output growth in both the periods. It shows  
271 that Indian economy has a very strong domestic market. Due to which, Indian economy was not much affected  
272 by global financial crisis emerged in 2007. <sup>1</sup>

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<sup>1</sup>Structural Changes in Indian Economy: An Empirical Analysis using Input-Output Structural Decomposition Analysis



Figure 1:

1

Economic Survey, 2006-07). If we compare the figures of output structure of manufacturing sector in 1993-94 with that of 2006-07 then it shows the signs of progress. With increase in shares of some of the industrial sectors; the share of secondary sector (sector 12 to 44) has increased from 30.53 to 35.50 percent in total output of the economy.

However, for service sector (sectors 45 to 58) the share of Construction (45), Other Transport Services (49), Communication (51), Hotels & Restaurants (53), Insurance (55), and Medical & Health has increased over the period of time. And there are some sectors move downward from their share in total output are Electricity (46), Gas & Water Supply (47), Railway Transport Services (48), Storage & Warehousing (50), Trade (52), Banking (54), Education & Research and Other Services. As per the Economic Survey 2006-07,

Figure 2: Table 1 :

2

In % age

Figure 3: Table 2 :

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**3**

(In % age)

Figure 4: Table 3 :



273 .1 Appendix Tables

- 274 [Forssell ()] ‘A Decomposition Technique for Analyzing Structural Changes in Production’. O Forssell . *Discussion*  
275 *Papers on Structural Analysis of Economic Systems* 1998. (8) . Cambridge Growth Project, Department of  
276 Applied Economics, University of Cambridge
- 277 [Dhawan ()] S Dhawan . *Structural Change and Growth in the Indian Economy: An Input-Output Approach,*  
278 *Unpublished Ph.D. Dissertation, IIT, (Kanpur, Kanpur)* 1993.
- 279 [Papola ()] ‘Emerging Structure of Indian Economy: Implication of growing Inter-Sectoral Imbalances’. T S  
280 Papola . *presented as 88th Conference of Indian Economic Association. Vishakhapatnam, December, 2005.*  
281 2005. p. .
- 282 [Guill ()] G D Guill . *Structural Changes in the Soviet Economy,* (Durham, N.C) 1979. Duke University  
283 (Unpublished Ph.D. Dissertation)
- 284 [Saxena et al. ()] ‘Output Growth in Post Liberalized India: An Input-Output Structural Decomposition  
285 Analysis’. K K Saxena , S Singh , R Arora . *Recession and Its Aftermath: Adjustments in the United*  
286 *States, Australia, and the Emerging Asia,* N M P Verma (ed.) (India) 2013. Springer.
- 287 [Source : Authors’ Calculations References Références Referencias] *Source : Authors’ Calculations References*  
288 *Références Referencias,*
- 289 [Sathe ()] *Structural Change in the Indian Economy: Some Evidence from the Pre-Reform Period,* D Sathe .  
290 [http://www.wordwendang.com/en/word\\_economy/1207/36742.html](http://www.wordwendang.com/en/word_economy/1207/36742.html) 1985.
- 291 [Union Budget and Economic Survey, Ministry of Finance, Government of India] *Union Budget and Economic*  
292 *Survey, Ministry of Finance, Government of India,* <http://indiabudget.nic.in/index.asp>
- 293 [Venkatramaiah et al. ()] P Venkatramaiah , A R Kulkarni , L Argade . *Structural Changes in Indian Economy:*  
294 *An Analysis with Input-Output Tables,* 1984. 26 p. 2.