LIBERALISATION AND SOURCES OF INDUSTRIAL GROWTH
IN INDIA: AN ANALYSIS BASED ON INPUT-OUTPUT APPROACH

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Abstract

India has experienced transformation from the regime of regulated economic development to competitive regime since the liberalisations of 1991. The main thrust of these liberalisations has been on industrial delicensing and openness, that is, import liberalisation and removing barriers to exports for accelerating growth. In this paper, an attempt has been made to analyze the effect of economic liberalisations on pattern of sources of growth of output of Indian manufacturing industry from a demand side perspective. The analysis has been based on Chenery's factor decomposition approach based on input-output framework. It decomposes output growth into its four sources: domestic demand expansion, export expansion, import substitution and intermediate demand expansion due to change in input-output coefficient. The basic data used for this study has been the input-output tables for 1983-84, 1989-90 and 1997-98. The analysis has been done separately for the pre-liberalisation period, 1983-84 to 1989-90, and the post-liberalisation period, 1989-90 to 1997-98, to examine the changing pattern in the sources of growth of output as a result of policy liberalisation and structural reforms during the 1990's. The nominal values of the variables have been deflated.

The study found that output growth in manufacturing industry has been mainly driven by domestic demand expansion followed by contribution of export expansion during both pre-liberalisation as well as post-liberalisation period, but after liberalisation the contribution of both domestic demand expansion and export expansion has increased. Further, contribution of both import substitution and intermediate demand expansion to output growth, which has been positive before liberalisation, has become negative. At disaggregated level of industries, there has been considerable similarity with some exceptions in pattern of sources of growth of output.

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1. Introduction

India has been following a highly protective industrial and foreign trade regime since 1951. The liberalisation of Indian economy started gradually in the 1980's and major economic liberalisations (structural adjustment programs) began from 1991. The protective regime controlled not only entry into industry and capacity expansion but also technology, output mix and import content. Import control and tariff provided high protection to domestic industry. There was increasing recognition by the end of 1980's that the slow and inefficient growth experienced by Indian industry was the result of a tight regulatory system provided to the Indian industry. Hence in July 1991 major economic reforms were undertaken with the objective of transforming the regime of regulated economic development to competitive regime for accelerating economic growth.

The new policies have liberalized many government controls on production capacity, imported capital goods, intermediate inputs and technology. The main thrust of these reforms has been on openness, that is, import liberalisation and removing barriers to exports. As the process of liberalisation is taking deeper roots with the continuous on going economic reforms, changes in the structure of Indian industries are inevitable. The reforms may increase import penetration or these may force domestic producers of some industries to improve their efficiency in order to meet the threat from imports and thereby contribute to domestic demand expansion. Import liberalisation may facilitate easy import of better intermediates and capital goods but this may adversely affect domestic suppliers of intermediate products. Openness may also lead to awareness or import of

better production techniques or technology that may change input-output coefficients which may affect intermediate demand. Openness may provide opportunities for sales in world markets and thus may lead to export expansion.

The demand side decomposition of output growth analyses the changes in the output induced by changes in domestic demand, exports, imports and intermediate input use i.e., input-output coefficients. Demand side decomposition is important as it helps in identifying the effects of government policies on growth of output of an industry and structural changes, as the individual components of demand reflect economic policies. Such an analysis is particularly important as demand pattern for different industries change with the passage of time due to changes in economy

The methodology of demand side decomposition analysis within the input-output framework was originally established by Chenery(1960) and extended by Chenery, Shishido and Watanabe (1962), Syrquin (1976), Chenery (1979) and Chenery, Robinson and Syrquin (1986). The method has also been applied in many other studies, such as: Celasun (1983), Kubo and Robinson (1984), Kubo, Melo and Robinson (1986), Forssell (1988), Urata (1988), Lee and Schluter (1993), Korres (1996) and Zakariah and Ahmad (1999).

For India, the methodology of demand side decomposition of output growth has been applied by: Ahmad (1968), Gupta (1989) and Bhardwaj and Chadha (1991). Ahmad (1968) analysis for period 1960-61 to 1965-66 indicated that at aggregate level, intermediate demand was the major source of industrial growth. Gupta (1989) for the period 1968-69 to 1981-82 and Bhardwaj and Chadha (1991) for the period 1973-74 to 1984-85 observed the dominance of domestic demand expansion at aggregate level. At the disaggregated level, the studies observed important variations from the aggregate pattern.

In this study, an attempt has been made to analyse the sources of output growth in Indian manufacturing industry for the period before liberalisation, 1983-84 to 1989-90, and after

liberalisation, 1989-90 to 1997-98, to identify the effect of liberalisation on pattern of sources of output growth in Indian manufacturing industry. The analysis is based on demand-side decomposition of output growth with in input-output framework.

The study is organized as follows. Section 2 discusses the model of demand side decomposition of output growth. The sources of data and construction of variables are given in Section 3. Section 4 discusses the results of demand side decomposition analysis. Section 5 states conclusion.

2. Model of Demand-Side Decomposition of Output Growth

The methodology of demand-side decomposition of output growth with in input-output framework is based on the factor decomposition method originally established by Chenery(1960) and extended by Chenery, Shishido and Watanabe (1962), Syrquin (1976), Chenery (1979) and Chenery, Robinson and Syrquin (1986). This is discussed below(for details see appendix 1):

The methodology of demand side decomposition of output growth is based on following accounting identity of demand and supply (material balance) in an input-output framework:

$$X_i = D_i + (E_i - M_i) + \sum_j X_{ij} \qquad \text{------------------(1)}$$

Where X_i= gross output of sector i

D_i =domestic final demand (consumption plus investment)

$(E_i - M_i)$= net trade(export minus competitive imports)

$\sum_j X_{ij} = \sum_j a_{ij} X_j$ =intermediate use of commodity i by sector j

$\{a_{ij}\}$ = input-output coefficients

Between two periods, change in output, ΔX, can be decomposed, into sum of four components namely domestic demand expansion (DD), export expansion (EE), import substitution (IS) and interemediate demand expansion due to change in input-output coefficient (IO). There are two methods, Laspeyres and Paasche, for the decomposition. Paasche type of decomposition measure is defined by using the terminal year structural coefficients and initial year volume weights whereas Laspeyres type of decomposition

measure is defined by using initial year structural coefficients and terminal year volume weights.

The average of the two alternatives, i.e., Laspeyres measure and Paasche measure has been used for decomposition of growth in this study. In several earlier studies, the average of Laspeyres and Paasche's methods of decomposition has been taken. (for example, Celasun, 1983 and Bhardwaj and Chadha, 1991.)

3. Sources of Data

The basic data used for this study is the input-output tables for 1983-84 and 1989-90 published by CSO and a table for 1997-98 prepared by NCAER. As the latest year for which input-output table published by CSO was available was for year 1993-94 only, therefore, for carrying out the analysis for post-liberalisation period, we had to use the input-output table prepared by NCAER. The input-output tables for 1983-84 and 1989-90, published by CSO, were for 115 sectors. But the table for 1997-98, prepared by NCAER was for 60 sectors. The input-output table for 1997-98, prepared by NCAER, for 60 sectors was based on the correspondence between 115 sectors and 60 sectors as given in Appendix 4 of Input-output table of 1993-94, published by CSO and presented in Appendix 3 of this paper. Therefore, to make these tables comparable, the input-output tables for years 1983-84 and 1989-90 were also aggregated to the 60 sectors classification, using the same correspondence table, to match these with 1997-98 table.

The given input-output tables were at current prices. However, for the analysis we required the table at constant prices. Therefore, to change all the variables in three input-output tables at constant prices, the nominal values of the variables were deflated. The nominal values of variables for 1983-84 and 1997-98 were deflated to 1989-90 prices, so that data for all the three years were at constant 1989-90 prices. Gross output has been deflated by wholesale price indices (WPI) taken from Index Number of Wholesale Prices in India, prepared by the Office of the Economic Advisor, Ministry of Industry. But as the classification used in WPI differs from that used in input-output tables, these were matched as closely as possible. Export unit value indices and import unit value indices

taken from RBI Hand-Book of Statistics were used to deflate exports and imports respectively. In this case also, the classification used for export unit value indices and import unit value indices were different from that given in input-output tables. These two classifications were also matched as closely as possible. To calculate input-output coefficients at constant prices, the method given by Celasun (1983) in his Turkey study. has been used. First of all, the flow matrices were converted to input-output coefficients. These input-output coefficients were then deflated to get the input-output coefficient matrix at constant 1989-90 prices. Details of the methods employed for the deflation of all the variables are given in Appendix 2.

After obtaining estimates of all four sources for 60 sectors, the estimates for various two digit industries were obtained as a sum total of corresponding source for constituent industries (see Appendix 4). Estimates for total manufacturing industry have been obtained as a sum total of all constituent industries.

4. Results of Decomposition of Sources of Output Growth

In this section we shall discuss the results of decomposing the output growth of each industry of manufacturing industry into its four sources: domestic demand expansion, export expansion, import substitution and intermediate demand expansion due to change in input-output coefficients. In order to consider the differences in the change of various sources of output growth after liberalisation, the analysis has been done separately for two sub-periods: pre-liberalisation period, 1983-84 to 1989-90 and post-liberalisation period, 1989-90 to 1997-98. The input-output coefficients as well as all the other variables required in the analysis have been converted to constant prices (1989-90).

Tables 1 & 2 present the results of decomposition analysis for sources of output growth during pre-liberalisation period and post-liberalisation period respectively for Indian manufacturing Industry. The table shows the percentage contribution of the four sources: domestic demand expansion, export expansion, import substitution and intermediate demand expansion due to change in input-output coefficients. Among the four sources of output growth, the source, which contributes the maximum to growth, has

been considered to be the dominant source. The industry is said to be domestic demand driven if the contribution of domestic demand expansion has been the maximum and export driven if contribution of export expansion has been the maximum, and so on.

4.1 Pre -Liberalisation Period

During pre-liberalisation period, table 1 shows that at the aggregate level of manufacturing industry, domestic demand expansion was the major source contributing 70.7 per cent to output growth, followed by export expansion contributing 13.8 per cent, import substitution contributing 12.3 per cent and intermediate demand contributing, 3.2 per cent, to output growth. At the disaggregate level of manufacturing industry, all industries except 2 industries: beverages & tobacco and wood & wood products, were showing increase in output. Table 1 shows that out of 15 industries showing an increase in output growth, while 13 industries were driven by domestic demand expansion, varying from 153.8 per cent in jute textiles to 42.6 per cent in chemicals and chemical products. One industry, leather & leather products, was driven by export expansion (77.8 per cent) and another industry, non-metallic mineral products, was driven by import substitution (56.0 per cent).

The contribution of domestic demand to output growth in all the 15 industries was positive, varying from 153.8 per cent in jute textiles to 8.2 per cent in leather & leather products. The contribution of export expansion to output growth was positive in 14 industries out of 15 industries, varying from 77.8 per cent in leather and leather products to 4.4 per cent in transport equipment. One industry, jute textiles, was showing negative contribution of export, - 20.5 per cent, to output growth. The contribution of import substitution to output growth was positive in all industries, except, cotton textiles, textile nec. and leather & leather products, varying from 68.5 per cent in jute textiles to 0.6 per cent in machinery industry. Among the industries showing a negative contribution of import substitution to output growth, maximum negative contribution was in leather and leather products being –6.1 per cent but in textile nec. it was -0.8 per cent and in cotton textiles it was –0.2 per cent. The contribution of intermediate demand to output growth was positive in 10 industries and negative in 5 industries. The positive contribution of intermediate demand to output growth varied from 21.6 per cent in chemical and

6

chemical products to 2.0 per cent in rubber and rubber products. Among the industries showing negative contribution of intermediate demand to output growth, the maximum negative contribution was in food products being –131.8 per cent followed by –101.8 per cent in jute textile and -30.2 per cent in basic metals and further less than -10 per cent in paper & paper products and cotton textiles.

For the industries showing decline in output, the decline in output of beverages and tobacco was caused by decline in domestic demand whereas the decline in wood and wood products was caused mainly due to decline in intermediate demand.

4.2 Post-Liberalisation Period

During post-liberalisation period, table 2 shows that at the aggregate level of manufacturing industry, like the pre-liberalisation period, domestic demand expansion continued as the major source contributing 95.7 per cent to output growth, followed by export expansion contributing 23.6 per cent to output growth. But the contribution of both domestic demand expansion and export expansion has increased during post-liberalisation period as compared to pre-liberalisation period. The contribution of import substitution to output growth however turned negative during post-liberalisation period, -17.7 percent, as compared to positive contribution of 12.3 per cent during pre-liberalisation period. The contribution of intermediate demand to output growth also turned negative, -1.5 per cent, as against positive contribution of 3.2 per cent during pre-liberalisation period. At the disaggregate level of manufacturing industry, the table reveals that all the 17 industries were showing an increase in output, as against pre-liberalisation period where two industries were showing a decline in output. All 17 industries except cotton textiles have been driven by domestic demand expansion. Cotton textiles has been driven by export expansion with a contribution of 147.6 per cent to output growth.

The contribution of domestic demand expansion to output growth was positive in 16 out of total of 17 industries, ranging from 367.8 per cent in the case of metal products to 73.2 per cent in the case of basic metals. The contribution of domestic demand was negative, -14.2 per cent, in case of cotton textiles. The contribution of

7

export expansion to output growth was also positive in 16 out of total of 17 industries, ranging from 147.6 per cent in the case of cotton textiles to 5.7 per cent in the case of machinery and equipment. The contribution of export was negative, -0.2 per cent, in beverages and tobacco products. Unlike pre-liberalisation period, where the contribution of import substitution was positive in almost all industries, during post-liberalisation period, the contribution of import substitution to output growth has been negative in all industries except beverages & tobacco products where the contribution of import substitution though positive was very small, merely 0.2 per cent. The negative contribution of import substitution varied from –175.9 per cent in the case of jute textiles to –2.3 per cent in the case of basic metals. The contribution of intermediate demand to output growth was negative in 11 industries and positive in 6 industries only as against pre-liberalisation period where it was positive in maximum number of industries. The positive contribution of intermediate demand to output growth varied from 53.2 per cent in other manufactures to 2.9 per cent in leather & leather products. The maximum negative contribution of intermediate demand to output growth was –314.8 per cent in the case of metal products. The negative contribution of intermediate demand in other industries varied from –119.7 per cent in jute textiles to -2.4 per cent in beverages and tobacco products.

4.3 Changing Pattern in the Sources of Output Growth from Pre-liberalisation Period to Post-liberalisation Period

In this section we shall compare the changes in pattern of sources of output growth during post-liberalisation period as compared to pre-liberalisation period in all the 17 manufacturing industries.

At the aggregate level of manufacturing industry, the pattern of sources of output growth remains unchanged from pre-liberalisation period to post-liberalisation period as domestic demand expansion followed by export expansion continued to be the main source of output growth during both the periods. But the relative contribution of both domestic demand expansion and export expansion has increased during post-liberalisation period over pre-liberalisation period. The relative contribution of both

import substitution and intermediate demand turned negative during post-liberalisation period as compared to positive during pre-liberalisation period. At the disaggregate level, all the industries have been showing increase in output during post-liberalization period as against pre-liberalisation period where two industries showed a decline in output. Therefore, changing pattern in sources of output growth shall be discussed for 15 industries showing increase in output in both the periods. Out of 15 industries which showed an increase in output in both the periods, in 12 industries, pattern of sources of output growth seems unchanged from pre-liberalisation to post-liberalisation period. All these 12 industries, food products, man made textiles, jute textiles, textile nec., paper & paper products, chemical & chemical products, rubber & rubber products, basic metals, metal products, machinery and equipment, transport equipment and other manufacturing, continued to be driven by domestic demand during both the periods. The industries in which pattern of sources of output growth has changed from pre-liberalisation to post-liberalisation period are: leather & leather products, which was driven by export expansion during pre-liberalisation period became domestically driven during post-liberalisation period; cotton textiles, which was domestically driven during pre-liberalisation period became export driven during post-liberalisation period; in non-metallic mineral products, which was driven by import substitution during pre-liberalisation period became domestic demand driven during post-liberalisation period. Out of 12 industries which maintained their pattern of sources of output growth with respect to the source of dominance as domestic demand expansion during both the periods, in 10 industries, man made textiles, jute textiles, textile nec, paper & paper products, chemical & chemical products, rubber & rubber products, metal products, machinery, transport equipment and other manufacturing, the relative contribution of domestic demand expansion has increased from pre-liberalisation period to post-liberalisation period. But in 2 industries, food products and basic metals, the relative contribution of domestic demand expansion has declined from pre-liberalisation period to post-liberalisation period.

Now looking at each source of growth, irrespective of whether it is source of dominance or not, and comparing it from pre-liberalisation to post-liberalisation period,

we shall examine in which industries their contribution has increased or decreased. The industries; beverages & tobacco and wood & wood products; which showed decline in output during pre-liberalisation period but increase in output during post-liberalisation period have not been discussed here. Table 3 gives the changing pattern in the contribution of domestic demand expansion. This table shows that there were 14 industries in common showing positive contribution of domestic demand expansion to output growth during both the periods. Out of these, in 12 industries the relative contribution of domestic demand expansion has increased from pre-liberalisation to post liberalisation period and in 2 industries the relative contribution of domestic demand expansion has declined from pre-liberalisation to post-liberalisation period. In one industry, cotton textiles, it has changed from positive during pre-liberalisation period to negative during post-liberalisation period.

The changing pattern of export expansion is shown in table 4. The table depicts that the relative contribution of export expansion to output growth has been positive in common in 14 industries during both the periods. Out of these 14 industries, in 7 industries, the positive contribution has increased from pre-liberalisation to post-liberalisation period and in other 7 industries, the positive contribution has decreased from pre-liberalisation period to post-liberalisation period. In one industry, jute textiles, the relative contribution has reversed from negative during pre-liberalisation period to positive during post-liberalisation period.

Table 5 gives the changing pattern of import substitution to output growth.. In 12 industries out of total of 15 industries, the contribution of import substitution has reversed from positive during pre-liberalisation period to negative during post-liberalisation period. In 3 industries, the contribution of import substitution has been negative during both the periods. Out of these in 2 industries, cotton textiles and textile nec., the negative contribution has increased from pre-liberalisation to post-liberalisation period but in one industries, leather & leather products, the negative contribution has decreased from pre-liberalisation to post-liberalisation period.

The changing pattern in the contribution of intermediate demand to output growth is given in table 6. The contribution of intermediate demand was positive during both the periods in 5 industries. Out of these 5 industries, in 3 industries, rubber & rubber

products, non-metallic mineral products and other manufacturing, the positive contribution of intermediate demand has increased from pre-liberalisation period to post-liberalisation period. But in 2 industries, leather & leather products and chemical & chemical products, the positive contribution of intermediate demand has declined from pre-liberalisation to post-liberalisation period. The relative contribution of intermediate demand to output growth has been negative during both the periods in 5 industries. Out of these 5 industries, in 3 industries, cotton textiles, jute textiles and paper & paper products, the negative contribution has increased from pre-liberalisation to post-liberalisation period. In the other 2 industries, food products and basic metals, the negative contribution has decreased from pre-liberalisation to post-liberalisation period. In 5 industries, manmade textiles, textile nec., metal products, machinery & equipment and transport equipment, the contribution of intermediate demand has changed from positive during pre-liberalisation period to negative during post-liberalisation period.

5. Conclusion

This paper analyses the effect of economic reforms on pattern of sources of growth of output in Indian manufacturing industry from a demand side perspective. The analysis has been done separately for the pre-liberalisation period, 1983-84 to 1989-90, and the post-liberalisation period, 1989-90 to 1997-98, to examine the changing pattern in the sources of growth of output as a result of policy liberalisation and structural reforms during the 1990's. The analysis has been done using Chenery's factor decomposition approach, based on input-output framework, decomposing output growth into its four sources: domestic demand expansion, export expansion, import substitution and intermediate demand expansion due to change in input-output coefficient.

 The analysis reveals that at the aggregate level of manufacturing industry, domestic demand expansion has been the dominant source of output growth, followed by export expansion during both pre-liberalisation period and post-liberalisation period. But the contribution of both domestic demand expansion and export expansion has increased during post-liberalisation period as compared to pre-liberalisation period. On the other

hand, contribution of both import substitution and intermediate demand to output growth has become negative during post-liberalisation period as compared to positive contribution during pre-liberalisation period. At disaggregate level also; increase in output of Indian manufacturing industries has been driven mainly by domestic demand expansion during both the periods.

The contribution of domestic demand expansion and export expansion was though positive in almost all industries during pre-liberalisation period and post liberalisation period. There were large number of industries, where the positive contribution of domestic demand expansion has increased where as for few industries it has declined from pre-liberalisation period to post-liberalisation period. The relative contribution of export expansion has increased for some industries but for some other industries it has declined from pre-liberalisation period to post-liberalisation period. The relative contribution of import substitution has reversed from positive during pre-liberalisation period to negative during post-liberalisation period in most of the industries. The relative contribution of intermediate demand expansion has been mixed. For some industries, the positive/negative contribution has increased or decreased, whereas for some other industries the contribution has reversed from positive to negative from pre-liberalisation period to post-liberalisation period.

The pattern of sources of output growth with respect to source of dominance remains unchanged during two periods but the relative contribution of each source of growth to output growth from pre-liberalisation to post-liberalisation period has increased for some other industries but has decreased for some other industries. On the other hand, for some of the industries the relative contribution has changed from positive during pre-liberalisation period to negative during post-liberalisation period or from negative during pre-liberalisation period to positive during post-liberalisation period.

The change in pattern of sources of output growth may have taken place due to liberalization policies and structural reforms undertaken during the 1990s. The liberalisation policies seems to have increased the consumption propensity which has been generating growth of demand reflecting the rising contribution of domestic demand expansion to growth of output. Export promotion policies over the two periods have generated increase in the contribution of export expansion to output growth. The

contribution of import substitution has changed from positive to negative from pre-liberalisation to post-liberalisation period may be due to changing import policies, with varying focus on liberalisation. The contribution of intermediate demand due to change in input-output coefficient to output growth has been mixed as technological policies have liberalized import of technologies over the periods. Technological changes have been material saving on one hand but capital intensive on the other hand. Technological changes have accordingly affected the input-output coefficients and their contribution to output growth.

Table 1

Sources of Output Growth In Indian Manufacturing Industry During Pre-liberalisation Period (1983-84 to 1989-90)

Industry Code	Description	Percentage contribution to output growth				
		Domestic Demand Expansion (DD)	Export Expansion (EE)	Import Substitution (IS)	Intermediate Demand Expansion (IO)	Total
Industries showing Output Growth						
20-21	Food products	110.56	77.19	44.01	-131.75	100
23	Cotton textiles	90.34	12.65	-0.17	-2.82	100
24	Manmade textiles	69.35	11.45	1.24	17.97	100
25	Jute textiles	153.82	-20.52	68.54	-101.84	100
26	Textile nec.	44.20	40.30	-0.79	16.29	100
28	Paper & paper products	67.49	16.78	22.63	-6.90	100
29	Leather & leather products	8.23	77.82	-6.13	20.08	100
30	Chemicals & chemical products	42.63	15.82	19.94	21.61	100
31	Rubber & rubber products	81.60	12.58	3.80	2.02	100
32	Non-Metallic mineral products	22.59	5.79	55.98	15.65	100
33	Basic metals & alloys	93.89	11.21	25.06	-30.15	100
34	Metal products	82.01	5.66	8.23	4.10	100
35&36	Machinery & equipment	78.06	7.69	0.55	13.69	100
37	Transport equipment	88.49	4.35	3.85	3.31	100
38	Other manufacturing	45.26	27.45	12.83	14.46	100
Industries showing Output Decline						
22	Beverages & tobacco	145.13	-68.88	0.60	23.15	100
27	Wood & wood products	-8098.57	-823.11	-136.87	9158.56	100
	Total manufacturing industry	70.69	13.80	12.31	3.20	100

Table 2

**Sources of Output Growth In Indian Manufacturing Industry During
Post-liberalisation Period (1989-90 to 1997-98)**

| Industry Code | Description | Percentage contribution to output growth | | | | |
		Domestic Demand Expansion (DD)	Export Expansion (EE)	Import Substitution (IS)	Intermediate Demand Expansion (IO)	Total
20-21	Food products	97.51	9.54	-4.11	-2.94	100
22	Beverages & tobacco	102.50	-0.24	0.16	-2.42	100
23	Cotton textiles	-14.21	147.58	-3.06	-30.31	100
24	Manmade textiles	96.50	14.86	-5.53	-5.83	100
25	Jute textiles	352.61	42.98	-175.93	-119.67	100
26	Textile nec.	73.40	68.28	-7.09	-34.59	100
27	Wood & wood products	93.74	8.64	-24.94	22.56	100
28	Paper & paper products	129.01	11.93	-5.30	-35.63	100
29	Leather & leather products	75.47	27.72	-6.11	2.92	100
30	Chemicals & chemical products	87.56	14.41	-8.52	6.56	100
31	Rubber & rubber products	129.94	24.46	-67.91	13.51	100
32	Non-Metallic mineral products	159.01	84.85	-163.18	19.33	100
33	Basic metals & alloys	73.18	31.94	-2.31	-2.81	100
34	Metal products	367.76	68.01	-20.94	-314.83	100
35&36	Machinery & equipment	129.69	5.74	-11.65	-23.78	100
37	Transport equipment	101.89	9.84	-2.95	-8.77	100
38	Other manufacturing	86.20	25.77	-65.20	53.24	100
	Total manufacturing industry	95.67	23.55	-17.73	-1.48	100

Table 3
Changing Pattern in the Contribution of Domestic Demand Expansion to Output Growth In Indian Manufacturing Industry from Pre-liberalisation to Post-liberalisation Period

Industries where positive contribution has increased	Industries where positive contribution has decreased	Industries where contribution has changed from positive to negative
Manmade textiles(24) Jute textiles(25) Textile nec(26) Paper&paper products(28) Leather&leather products(29) Rubber&rubber products(31) Chemicals&chemical products(30) Non-metallic mineral products(32) Metal products(34) Machinery &equipment(35&36) Transport equipment(37) Other manufactures(38)	Food Products(20-21) Basic metals(33)	Cotton Textiles(23)

Note: The table excludes the industries: beverages & tobacco and wood & wood products as these industries showed decline in output in pre-liberalisation period but increase in output in post-liberalization period.

Table 4
Changing Pattern in the Contribution of Export Expansion to Output Growth In Indian Manufacturing Industry from Pre-liberalisation to Post-liberalisation Period

Industries where positive contribution has increased	Industries where positive contribution has decreased	Industries where contribution has changed from negative to positive
Cotton Textiles(23) Manmade textiles(24) Rubber&rubber products(31) Non-metallic mineral products(32) Basic metals(33) Metal products(34) Transport equipment(37)	Food Products(20-21) Textile nec(26) Paper&paper products(28) Leather&leather products(29) Chemicals&chemical products(30) Machinery &equipment(35&36) Other manufactures(38)	Jute textiles(25)

Note: The table excludes the industries: beverages & tobacco and wood & wood products as these industries showed decline in output in pre-liberalisation period but increase in output in post-liberalizationperiod.

Table 5
Changing Pattern in the Contribution of Import Substitution to Output Growth In Indian Manufacturing Industry from Pre-liberalisation to Post-liberalisation Period

Industries where negative contribution has increased	Industries where negative contribution has decreased	Industries where contribution has changed from positive to negative
Cotton Textiles(23) Textile nec. (26)	Leather& leather products(29)	Food products (20-21) Manmade textiles (24) Jute textiles (25) Paper&paper products (28) Chemicals &chemical products(30) Rubber&rubber products(31) Non-metallic mineral products(32) Basic metals(33) Metal products(34) Machinery &equipment(35&36) Transport equipment(37) Other manufactures(38)

Note: The table excludes the industries: beverages & tobacco and wood & wood products as these industries showed decline in output in pre-liberalisation period but increase in output in post-liberalization period.

Table 6
Changing Pattern in the Contribution of Intermediate Demand Expansion to Output Growth In Indian Manufacturing Industry from Pre-liberalisation to Post-liberalisation Period

Industries where Positive contribution has increased	Industries where positive contribution has decreased	Industries where negative contribution has increased	Industries where negative contribution has decreased	Industries where contribution has changed from positive to negative
Rubber & rubber products(31) Non-metallic mineral products(32) Other manuf.(38)	Leather & leather products(29) Chemicals & chemical products(30)	Cotton Textiles(23) Jute textiles(25) Paper & paper products (28)	Food Products (20-21) Basic metals(33)	Manmade textiles(24) Textile nec(26) Metal products(34) Machinery &equipment(35& 36) Transport equipment(37)

Note: The table excludes the industries: beverages & tobacco and wood & wood products as these industries showed decline in output in pre-liberalisation period but increase in output in post-liberalizationperiod.

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Appendix 1

Model for Demand Side Decomposition of Output Growth

The methodology of demand-side decomposition of output growth used in this study is based on the factor decomposition method originally established by Chenery(1960) and followed by Chenery, Shishido and Watanabe (1962), Chenery(1969), Syrquin (1976), Chenery (1979) and Chenery, Robinson and Syrquin (1986). This is discussed below:

The methodology of demand side decomposition of output growth is based on following accounting identity of demand and supply (material balance) in an input-output framework:

$$X_I = D_i + (E_i - M_i) + \sum_j X_{ij} \qquad \text{------------(1)}$$

Where,

X_i = gross output of sector i

D_i = domestic final demand (consumption plus investment)

$(E_i - M_i)$ = net trade (export minus competitive imports)

$\sum_j X_{ij} = \sum_j a_{ij} X_j$ = intermediate use of commodity i by various sectors

$\{a_{ij}\}$ is the matrix of input-output coefficients, which is assumed to vary with the level of per capita income. Also changes in technology cause changes in a_{ij}.

Chenery (1960), using the properties of input-output system, equated increase in production of sector to the sum of following four components:

(i)   Domestic demand expansion (DD):

The expansion of domestic demand includes the direct demand for commodity i plus the indirect effects on sector i of expansion of domestic demand in other sectors i.e., the total effect on the output from each sector of expansion of domestic demand in all sectors.

(ii) Export expansion (EE):

Export expansion is the total effect on output from sector i of increasing exports (both exports of commodity i and exports of other commodities).

(iii) Import Substitution (IS):

Import substitution is the total effect on output from sector i of increasing the proportion of demand in each sector that is supplied from domestic production.

19

(iv) Technological Change or intermediate demand expansion due to change in input-output coefficients (IO):

Technological Change or intermediate demand expansion due to change in input-output coefficients is the total effect on output from sector i of changing input-output coefficients throughout the economy as wages and income level rise.

The derivation of the four components of output growth is done as follows:

In matrix notation, equation (1) can be written as

$$X = D + E - M + W \hspace{3cm} \text{-------(2)}$$

$$\text{Where,} \quad W = AX \hspace{3cm} \text{-------(3)}$$

and A is the matrix of input-output coefficients and X is the output vector.

Let mi denotes import ratio, calculated as imports to total domestic supply, i.e.,

$$mi = Mi / (Di+Wi) \hspace{3cm} \text{----------(4)}$$

Thus imports, Mi, is given as

$$Mi = mi \ (Di+Wi)$$

In matrix notation,

$$M = m \ (D+W) = m \ (D + AX) \hspace{2.5cm} \text{-----------(5)}$$

$$\text{since} \quad W = AX$$

Substituting (3) and (5) in (2) we get

$$X = D + E - m \ (D+AX) + AX$$

$$= (I-m) \ D + (I-m) \ AX + E$$

$$= \mu D + \mu AX + E \hspace{3cm} \text{-------(6)}$$

where $\mu = (I-m)$ is a diagonal matrix of $(1-m)$.

This implies

$$X - \mu AX = \mu D + E$$

$$\text{Or} \quad X = (I - \mu A)^{-1} \ (\mu D + E)$$

Taking the decomposition of output change over a period implies

$$\Delta X = X_1 - X_0$$

$$= (I - \mu_1 A_1)^{-1} \ (\mu_1 D_1 + E_1) - X_0$$

$$= R_1 \ (\mu_1 D_1 + E_1) - X_0 \quad \text{where } R_1 \text{ denotes the Leontief inverse matrix } (I - \mu_1 A_1)^{-1}$$

$= R_1\mu_1 D_1 + R_1 E_1 - X_0$

$= R_1\mu_1 D_1 + R_1 E_1 + R_1\mu_1 D_0 + R_1 E_0 - R_1\mu_1 D_0 - R_1 E_0 - X_0$

(adding and subtracting both $R_1\mu_1 D_0$ and $R_1 E_0$)

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - R_1 R_1^{-1} X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - R_1 (I - \mu_1 A_1) X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - R_1 X_0 + R_1\mu_1 A_1 X_0$

$= R_1\mu_1(D_1 - D_0) + R_1(E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - R_1 X_0 + R_1\mu_1 A_1 X_0 + R_1\mu_1 A_0 X_0 - R_1\mu_1 A_0 X_0$ (adding and subtracting $R_1\mu_1 A_0 X_0$)

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1 D_0 + R_1 E_0 - R_1 X_0 + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1 A_0 X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1 A_0 X_0 + R_1\mu_1 D_0 + R_1 E_0 - R_1 X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1 A_0 X_0 + R_1\mu_1(D_0 - R(X_0 - E_0)$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1(A_0 X_0 + D_0) - R_1 (X_0 - E_0)$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1(A_0 X_0 + D_0) - R_1 (X_0 - E_0)$

----------(7)

From (6)

$X_0 = \mu_0 D_0 + \mu_0 A_0 X_0 + E_0$ ------------------(8)

Therefore,

$X_0 - E_0 = \mu_0 D_0 + \mu_0 A_0 X_0 = \mu_0 (A_0 X_0 + D_0)$ ------------------(9)

Substituting (9) into (7) we get

$\Delta X = X_1 - X_0$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1\mu_1(A_0 X_0 + D_0) - R_1\mu_0(A_0 X_0 + D_0)$

$= R_1\mu_1(D_1 - D_0) + R_1 (E_1 - E_0) + R_1\mu_1(A_1 - A_0) X_0 + R_1 (\mu_1 - \mu_0) (A_0 X_0 + D_0)$

$= R_1\mu_1\Delta D + R_1\Delta E + R_1\mu_1\Delta A X_0 + R_1\Delta\mu (A_0 X_0 + D_0)$

$= R_1\mu_1\Delta D$ (Domestic Demand expansion Effect)

$+ R_1\Delta E$ (Export Expansion Effect)

$+ R_1\mu_1\Delta AX_0$ (Import Substitution Effect)

$+ R_1\Delta\mu (A_0X_0 + D_0)$ (Intermediate Demand Expansion Effect due to change in input- output coefficient)

The above decomposition has been defined by using the terminal year structural coefficients and initial year volume weights. This version is analogous to Paasche price index. The decomposition can also be done by using initial year structural coefficients and terminal year weights. This version is analogous to Laspeyres price index. Thus decomposition based on Laspeyres price index can also be obtained after certain algebric steps as done for Paasche price index and is as follows:

$\Delta X = R_0\mu_0\Delta D$ (Domestic Demand Expansion Effect)

$+ R_0\Delta E$ (Export Expansion Effect)

$+ R_0\mu_0\Delta AX_1$ (Import Substitution Effect)

$+ R_0\Delta\mu (A_1X_1 + D_1)$ (Intermediate Demand Expansion Effect due to change in input-output coefficient)

The average of the two alternatives, i.e., Laspeyres measure and and Paasche measure has been used for decomposition of output growth in this study. In several earlier studies, the average of Laspeyres and Paasche's methods of decomposition has been taken.(for example, Celasun, 1983 and Bhardwaj and Chadha, 1991.)

Appendix 2

Methods Of Deflation Of Variables

Details of the methods employed for the deflation of output, exports, imports, domestic demand, intermediate demand and input-output coefficients are given below:

Output, Exports, Imports

Gross output had been deflated by wholesale price indices (WPI) taken from Index Number of Wholesale Prices in India, prepared by the Office of the Economic Advisor, Ministry of Industry. We first constructed the WPI indices for 115 sectors. But as the classification used in WPI differs from that used in input-output tables, these were matched as closely as possible. For some sectors, the available wholesale price index series could be used directly. In some other cases, an weighted average of available category-wise price indices have been taken as the price index for the relevant input-output sector, weights being those given in wholesale price indices for each category. For some sectors, no suitable price index was available. Therefore, some approximation became necessary, and the best price index among the available ones was applied. For service sectors, implicit price deflator taken from National Accounts Statistics has been used to deflate. After constructing the WPI for 115 sectors, WPI for 60 sectors were obtained as the weighted average of corresponding sectors used in the aggregation of 60 sectors respectively with 1989-90 gross output as weights. The index number of wholesale prices were given with base 1981-82=100. These prices were converted to 1989-90 base.

Export unit value indices and import unit value indices taken from RBI HandBook of Statistics, 1999 have been used to deflate exports and imports respectively. In this case also, the classification used for export unit value indices and import unit value indices was different from that given in input-output tables. These two classifications were also matched as closely as possible. Like WPI, export unit value indices and import unit value indices were also constructed first for 115 sectors and then obtained for 60 sectors as weighted average of corresponding sectors with exports and imports for 1989-90 as weights. Like WPI, export unit value indices and import unit value indices for some sectors could be used directly but for some other sectors, an weighted average of available indices

has been taken as the index for relevant sectors, weights being volume of exports or imports respectively. The sectors for which, export or import unit value indices were not available, the other suitable deflator either wholesale price index (WPI) or implicit price deflator taken from National Accounts Statistics has been used. For service sectors, implicit price deflator taken from National Accounts Statistics has been used. Export unit value indices and import unit value indices were given at 1978-79 base. The base of export unit value indices and import unit value indices have also been converted to base 1989-90.

To calculate input-output coefficients at constant prices we have followed the method given by Celasun (1983) in his Turkey study. First of all, the flow matrices were converted to input-output coefficients. These input-output coefficients were then deflated to get the input-output coefficient matrix at constant 1989-90 prices.

Domestic Demand and Intermediate demand

Both domestic demand as well as intermediate demand at current prices have been deflated by price index of sectoral supply for domestic use, equal to the ratio of sectoral supply for domestic use at current prices to that at constant prices (for details see Celasun, 1983). Thus, the price index for sector i was obtained as:

$$P_i(s) = (X+M-E)/(XD+MD-ED) \qquad \text{-----(A.1)}$$

Where, X, M and E denote production, imports and exports respectively for i'th sector at current prices and XD, MD and ED denote production, imports and exports for the sector at constant prices.

Input-Output Coefficients

As mentioned above, the flow matrices were first converted to input-output coefficients. Each flow item for a sector in a column had been divided by gross output for that sector. These input-output coefficients were then deflated by a suitable deflator constructed as follows:

If $\{a_{ij}\}$ are input-output coefficients at current prices and $\{a_{ij}^d\}$ are input-output coefficients at constant prices, then

$$\{a_{ij}^d\} = \{a_{ij}\}*(P_j(x)/P_i(s)) \qquad \text{-------------------(A-2)}$$

where $P_j(x)$ is the price index for output and $P_i(s)$ is the price index of sectoral supply for domestic use (explained above).

Output Growth at Constant Prices

Material balance equation in current prices is given as:

$$X_i = D_i + (E_i - M_i) + \sum a_{ij} X_j \qquad \text{------------(A.3)}$$

A constant prices and also using matrix notation this can be written as:

$$XD = (I-AD)^{-1}(DD+ED-MD) \qquad \text{--------(A.4)}$$

Where $AD = \{a_{ij}^d\}$ and $\{a_{ij}^d\}$ is input-output coefficients matrix at constant prices and DD, ED and MD are domestic demand, exports and imports at constant prices respectively. XD obtained by equation (A-4) should be approximately equal to XD obtained by deflating output by price indices of output. But due to rounding errors in the estimation of AD,DD,ED and MD and inverse matrix, $(I-AD)^{-1}$, these two sets of estimates will only be approximately equal. The estimates obtained by equation (A-4) has been used in the calculation of production growth.[1]

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[1] 1 See Celasun (1983) for details

Appendix 3

Correspondence Between Aggregated 60 Sector Classification
And 115 Input-Output Sectors

Sector Code	Description of 60 Sectors	Sectors in 115 sector I-O
S1	food crops	1,2,3,4,5,6,7
S2	cash crops	8,9,10,11,16
S3	Plantation crops	12,13,14,15
S4	other crops	17
S5	animal husbandry	18,19,20
S6	forestry and logging	21
S7	Fishing	22
S8	coal and lignite	23
S9	crude petroleum and natural gas	24
S10	iron ore	25
S11	other minerals	26,27,28,29,30,31,32
S12	Sugar	33,34
S13	food products excluding sugar	35,36,37,38
S14	Bevereages	39
S15	tobacco products	40
S16	cotton textiles	41,42
S17	wool, silk and synthetic fibre textiles	43,44,45
S18	jute, hemp and mesta textiles	46
S19	textiles products including wearing apparel	47,48,49
S20	wood and wood products except furniture	51
S21	furniture and fixture	50
S22	paper and paper products	52
S23	printing, publishing and allied activities	53
S24	leather and leather products	54,55
S25	plastic and rubber products	56,57
S26	Petroleum products	58
S27	coal tar products	59
S28	inorganic heavy chemicals	60
S29	organic heavy chemicals	61
S30	Fertilizers	62
S31	paints, varnishes and lacquers	64
S32	pesticides, drugs and other chemicals	63,65,66,67,68
S33	Cement	70
S34	non-metallic mineral products	69,71
S35	iron and steel industries and foundries	72,73,74

	Description of 60 Sectors	**Sectors in 115 sector I-O**
S36	other basic metal industry	75
S37	metal products except mach. and tpt. Equipment	76,77
S38	agricultural machinery	78
S39	agricultural machinery for food and textiles	79
S40	other machinery	80,81,82,83
S41	electrical, electronic, machinery and appliances	84,85,86,87,88,89,90
S42	railway transport equipment	92
S43	other transport equipment	91,93,94,95,96
S44	miscellaneous manufacturing industries	97,98
S45	Construction	99
S46	Electricity	100
S47	gas and water supply	101,102
S48	railway transport services	103
S49	Other transport services	104
S50	storage and warehousing	105
S51	Communication	106
S52	Trade	107
S53	hotels and restaurants	108
S54	Banking	109
S55	Insurance	110
S56	ownership of dwellings	111
S57	education and research	112
S58	medical and health	113
S59	other services	114
S60	public administration and defence	115

Source: Input-Output Table, 1993-94, CSO, Appendix 4

Appendix 4

Correspondence Between ASI Two Digit Industry Group
And Input-Output 60 Sector Classification

S.No.	ASI Code	ASI Industry Group	Input-Output 60 Sector Classification
1	20-21	Food Products	S 12, S13
2	22	Beverages & tobacco	S14, S15
3	23	Cotton Textiles	S16
4	24	Man-made Textiles	S17
5	25	Jute textiles	S18
6	26	Textile nec.	S19
7	27	Wood & wood products	S20, S21
8	28	Paper & paper products	S22, S23
9	29	Leather & leather products	S24
10	31	Rubber & rubber products	S25, S26, S27
11	30	Chemicals & chemical products	S28, S29, S30, S31, S32
12	32	Non-metallic mineral products	S33,S34
13	33	Basic Metals	S35, S36
14	34	Metal products	S37
15	35&36	Machinery & equipment	S38, S39, S40, S41
16	37	Transport equipment	S42, S43
17	38	Other manufacturing	S44