Standard System and Bottlenecks to Growth in the Indian Economy: A Study Based on Input-Output Tables (93-94)

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The standard system is in balanced standard proportions, which permit growth without bottlenecks. This study estimates the standard system in the Indian Economy from the input-output tables prepared by the CSO, and use the standard proportions to identify sectors that are a bottleneck to 10% growth of the economic system.

The study identifies 26 such sectors, of which 10 appear to be serious bottlenecks, with shortages of more than 1% of the total available resources in 1993-4. Crude oil with a shortage of 15.5%, coal with 13.6%, electricity with 3.8%, inorganic heavy chemicals with 3.3%, fertilisers with 2.6%, pesticides with 2.1% are some of the serious bottleneck sectors. Groundnuts, paper and animal services with about 2% shortfalls appear to be other serious cases of shortfalls at 10% growth rate.

Key words: Standard proportions, Standard proportions, bottleneck sectors.

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I. Standard System

1.1 Embedded in every economy is a standard system (Sraffa, 1960), that consists of all basic commodities, and may be constructed by unique multipliers. It is possible to detect the standard system in the Input Output Transactions Table (1993-94) published by the CSO (2000) for India. The relation between the Leontief input output tables and Sraffa's system is explored in Pasinetti (1977).

1.2 One characteristic of a standard system is that since it is in balanced or standard proportions, it assures the maximum rate of growth of itself. Since the resources are in

standard proportions there are no bottlenecks to growth. However goods that can actually be allocated to the standard system may not be in standard proportions, in which case bottlenecks develop. By comparing the structure of resources available for allocation to the standard system, with the standard proportions, we can identify sectors that pose a bottleneck to economic growth.

1.3 Of the total resources of an economy X_T, a part is used to produce goods and services for consumption and exports X_{ce}. The remaining surplus is available for allocation to standard system (X_S), producing fixed assets outside the standard system or for adding to stocks. If we assume that the last two are the same from year to year, the growth of the standard system weighted by its share in the total resources becomes the rate of expansion of the total resources of the economy.

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1.4 Formally,

$$\Delta X_T = g_s \, . \, X_S \,,$$

On dividing both sides by X_T, we get:

$$g = \frac{\Delta X_T}{X_T} = g_S \times \frac{X_S}{X_T} \qquad \ldots \qquad [1]$$

Thus, the growth rate of the standard system, multiplied by the rate of allocation of resources to the standard system (X_S/X_T), determines the rate of growth of the economy.

1.5 Using the 114 sector input output transaction table[i], we find the maximum eigen value of the A matrix (Pasinetti L., 1977, para 3.3, p. 203) or the growth coefficient to be 2.225259. This means that the rate of growth of the standard system is 123% per annum in India.[ii] What is likely to be its rate of allocation in the Indian Economy?

II. Surplus Resources

2.1 We define the total resources available to the economy at a given time (X_T) as the sum of: gross output, imports, and reductions in stocks. Gross output is currently produced, and imports and reductions in stocks may be considered to be withdrawal of resources across national space and from the past, respectively. Together, they are the sum total of resources available for the economy X_T. In the 1993-4 tables, the total resources X_T available to the Indian Economy are Rs. 15,67,81,358 lakh.

2.2 Part of these resources (X_{ce}) are used to produce final goods for private consumption (pfc), government consumption (gfc) and exports (xp). X_{ce} can be calculated by manipulating the basic equation:

$$A X_{ce} + (pfc + gfc + xp) = X_{ce} \qquad \ldots [2]$$

Where A is the input-output coefficient matrix corresponding to X_T.

Manipulation of [1] gives X_{ce} as:

$$X_{ce} = [I - A]^{-1} [pfc + gfc + xp] \qquad \ldots [2a]$$

X_{ce} is estimated to be Rs. 11,72,77,758 lakh (X_{ce}) from the 1993-94 tables in India. The difference between the total resources and X_{ce} is the surplus: Rs. 39,50,36,00 lakh or 25.2% of the total resources (Rs. 39,50,36,00 lakh ÷ Rs. 15,67,81,358 lakh = 25.2%).

2.3 Only part of these surplus resources can be invested in the standard system.[iii] This is because they are not in standard proportions. When we attempt standard proportions for the whole surplus, many of the sectoral balances become negative indicating strong bottlenecks. Hence, only that portion of the surplus that permits growth without bottlenecks can be

invested in the standard system. The remaining may be used to add to fixed assets and stocks outside the standard system.

The portion of the surplus that can be used in the standard system depends upon the standard proportions or the balanced proportions in which resources are used in the standard system.

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III. Standard Proportions and the Importance of Industries in the Standard System

3.1 A cursory look at the Input output tables shows that virtually all goods/services are used to produce everything else. This is confirmed by the first eigen vector of the A matrix. This vector yields the standard proportions, and it gives zero weight only to one sector: ownership of dwellings, that do not directly or indirectly enter into the production of all other commodities (Table A1, Appendix). All other sectors are 'basic' in Sraffa's sense, given the way the tables are constructed.

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Table 1: Weightage to Broad Groups in Standard System

Row	Groups	Weightage
1	Animal Husbandry, forestry and fishing	1.4%
2	Agriculture	4.0%
3	Agro-based Industries	5.2%
4	other industries	5.2%
5	Petroleum, chemical, fertilisers and pesticides	8.9%
6	Equipment & construction	9.2%
7	Transport services	9.4%
8	Trade and Commn.	9.9%
9	Metals	10.7%
10	Banking insurance and all other services	11.2%
11	Electricity	12.0%
12	Minerals	12.9%

3.2 The weightage given in the standard system may also be summed up by broad groups of sectors as in Table 1 for added insight. The sectors have been arranged in ascending order of the weights. The table shows that agriculture and allied activities get only 5.4% weight (rows 1&2), and agro-based industries another 5% (row 3). In contrast, other services (row 4), petrol & chemicals (row 5), equipment & construction (row 6), transport services (row 7), trade and commn. (row 8), metals (row 9) and electricity (row 11), all get between 9–11% weightage, with minerals (row 12),having a weight of about 13%.

3.3 Table 2 shows some important industries in the standard system. It seems that electricity is the most important, with a weight of 12%. This is not surprising, since electricity powers nearly everything in modern life.

Electricity is followed in importance by trade 8.7%, iron etc. 6.8%, other transport services 6.1%, coal 5.7%, crude 5.4%, and banking 5.4%. Other services and railway transport services are also important.

Table 2: Important Individual Industries in Standard System

Code	Sector	standard proportions
100	Electricity	12.0%
107	Trade	8.7%
72	Iron, steel and ferro alloys	6.8%
104	Other transport services	6.1%
23	Coal and lignite	5.7%
24	Crude petroleum, natural gas	5.4%
109	Banking	5.4%
114	Other services	3.5%
103	Railway transport services	3.3%

IV. Allocation of Surplus to the Standard System

4.1 Given the standard proportions, what is the portion of surplus that can be allocated to the standard system such that it can grow without bottlenecks? We find that when 15.2% of

the surplus, or 3.82% of the total resources[iv], are allocated to the standard system, it grows without any bottlenecks, with the exception of groundnuts, that show a negative balance of 0.3% of the total groundnut resources. The details are appended in Table A2.

4.2 By equation [1], an allocation of 3.82% of total resources implies a growth rate of total resources of about 4.7% (3.82 × 123% = 4.6986%). This figure is fairly close to the actual Indian economic growth, which was about 5% in 1993-94.

4.3 Planners today aim at an expansion rate of over 10% per annum. This would imply that the resources allocated to the standard system be more than doubled to 8% of the total resources or 32% of the surplus.[v] At this rate of allocation, negative balances develop in 26 of the 113 sectors, with 10 sectors exhibiting a shortage of more than 1% of their gross availability. The details are appended in Table 3 below.

4.4 As is evident from the left hand panel of the table, crude oil and gas top the list with a shortage of 15.5% of the total oil resources available in 1993-94, at 10% growth. They are followed closely by coal with a shortage of 13.6%. Electricity (3.8%), inorganic heavy chemicals (3.3%), fertilisers (3.6%), pesticides (2.1%) are other serious bottleneck sectors. Groundnuts, chemicals, animal services and Medical and health also show shortages of ≥1%. The right hand panel of the table provides details of the other 16 sectors, mostly agricultural or agro-based, that exhibit shortages of < 1% of the gross availability.

4.5 Thus, if we wish to raise the growth rate to over 10% p.a., the bottleneck sectors have to be attended to, either in terms of their production potential or import possibilities. That way lies the path to accelerated development.

Table 3: Bottleneck Sectors at 10% Growth Rate

Code	Sector	Shortage as % of Gross Availability	Code	Sector	Shortage as % of Gross Availability
24	Crude petroleum, natural gas	-15.5%	34	Khandsari, boora	-0.6%
23	Coal and lignite	-13.6%	43	Woolen textiles	-0.4%
100	Electricity	-3.8%	2	Wheat	-0.3%
60	Inorganic heavy chemicals	-3.3%	36	Edible Oils other than vanaspati	-0.2%
62	Fertilizers	-2.6%	41	Khadi, cotton textiles (handlooms)	-0.2%
9	Groundnut	-2.2%	108	Hotels and restaurants	-0.2%
63	Pesticides	-2.1%	8	Sugarcane	-0.2%
52	Paper, paper prods. & newsprint	-2.1%	18	Milk and milk products	-0.2%
19	Animal services(agricultural)	-2.1%	55	Leather and leather products	-0.2%
113	Medical and hearth	-1.6%	44	Silk textiles	-0.2%
68	Other chemicals	-0.9%	35	Hydrogenated oil (vanaspati)	-0.1%
			96	Other transport equipment	-0.1%
			112	Education and research	0.0%
			38	Miscellaneous food products	0.0%

V. Conclusion

5.1 This paper identifies the standard system embedded in the Input-output Tables published by the Planning Commission for 1993-4. It estimates the weight given to individual sectors in the standard system, by individual sectors and by broad groups. These weights reflect the standard proportions. The study shows that only 15% of the resources available after supplying consumption and export demand in 1993-4, can be put in standard proportions. Such an allocation would imply a growth rate of 4.7% which was close to the actual economic growth in India in that year. If the economy is to grow at about 10% per annum, the allocation of resources would have to be more 30% of the 'surplus' or about 8% of the total resources of the economy. However, the structure of these resources is not in standard proportions, and about 25 industries develop bottlenecks. Of these 10 sectors have 'serious' bottlenecks of $\geq 1\%$ of the gross availability in that sector. These potential

bottlenecks will have be cracked by breakthroughs in production or increased imports to achieve a two digit growth rate.

References

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ENDNOTES

[i] The 115th sector, viz., public administration is dropped from the analysis as it largely serves a notional purpose.

[ii] This may seem to be a very high rate of growth. But it is worth recalling that a large part of the resources of the economy have to be used to satisfying consumption and export demand, and only part of the remaining resources can be possibly allocated for the growth of the standard system.

[iii] Since the standard system derives from surplus resources, after human consumption is met, it excludes wages, and includes only technical, and organisational inputs such as hotels, trade, banking and insurance.

[iv] Since the rate of surplus is 25.2%, we get: $15.2\% \times 25.2\% = 3.82\%$

[v] By equation [1], $10\% = 123\% \times X_S/X_T \Longrightarrow X_S/X_T = 10 \div 123 = 8\%$