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## *Full Length Research Article*

# STUDY OF LINKAGES OF SERVICE SECTOR IN INDIA

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**ABSTRACT**

The study attempts to evaluate sectoral linkages of the service sectorof Indian economy by means of input output analysis. The data source of the study is the input output table consisting 130 sectors for the year 2007-08 (published in 2012) prepared by CSO which, for the purpose of analysis has been consolidated to 20sectors.By means of input output analysis,backward linkages, forward linkages and multiplier effects for the service sector has been determined.Both backward and forward linkages are used to identify the key sectors within the service sector.The findings of the study confirm the significance of the service sectorfor the economic development of the economy and identifies, transport, business services and restaurants and hotels as key sectors within the services.



## INTRODUCTION

There are two accelerations in GDP growth that has taken place in India's growth process since 1950's, one in early 1980s and other towards the end of 1990s and both of these accelerations associated with increased growth of services. The services are consumed either directly or as intermediate inputs. The direct contribution in the form of output and employment generation shows staggering finding that the sector's contribution to GDP is far ahead than its contribution towards employment. Therefore, it provides rationale to analyze the indirect contribution made by the service sector as intermediate inputs to other sectors of the economy. These intermediate services, play important role in development process rather than contributing directly to GDP and employment creation. Two basic models are used for analyzing Input Output tables namely, the Leontief (1936) and Ghosh (1958) approaches. The former approach is demand driven while the latter is supply driven. By means of input output analysis, backward linkages and forward linkages for the service sector have been determined. Two different approaches are found in measurement of linkages which are Chenery and Watnabe (1958) and Rasmussen's (1956).

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The estimation of direct backward linkages and direct forward linkages is based on suggestions proposed by Chenery and Watnabe (1958) while estimation of indirect backward and forward linkages is based on Rasmussen's method(1956).Both backward and forward linkages are used to identify the key sectors on the basis of Hirschman(1958) criterion, according to which, the priority sectors in which investment is to be concentrated are those with high values of backward and forward linkage effects. Thus, sectors with backward and forward linkages greater than one are considered key sectors.Thus, the objective of the present study is to determine the indirect contribution made by service sector in the Indian economy by examining its linkages with other sectors and also identifying the key sectors using input output table of the Indian economy for the year 2007-08.Further having assessed the backward and forward linkages, additional indicators have been evaluated in the study which includes, output multiplier and input multiplier.There are two types of linkages, backward linkages and forward linkages where former measures the inducement to production in other sectors while the latter measures the extent to which the sector provides inputs for utilization by other sectors.

## MATERIALS AND METHODS

The study primarily uses the latest Input Output table of Indian economy for the year 2007-08 (published in 2012)

prepared by Central Statistical Office (CSO) of the Government of India responsible for generating the National Accounts Statistics for the country. The tables is in the form of square matrix and gives the flow of goods and services from each sector of the economy to different sectors of the economy over a period of one year normally. The table originally gives input output flow for 130 sectors of the Indian economy but for measuring inter-linkages,it has been consolidated to 20 sectors input output tablewith fourteen sectors from services, rest of the six sectors include agriculture, animal husbandry, mining and quarrying and manufacturing, construction, electricity and water supply.

**Basic Input Output Model**

The analysis of input output table identifies the interdependence of production and consumption in an economy. The inter-sectoral flows are expressed in monetary terms for a particular year where the flows represent intermediate goods and services. On one hand, the output produced in any sector requires various inputs like capital, labour and raw materials on the other hand, this produced output is required to satisfy intermediate input demand (i.e as input for further production of goods and services by other sectors and by own sector) as well as to satisfy final demand (i.e use of output for government, private consumption, capital formulation, Exports, Imports) CSO (2012),thus creating interdependence among the sectors. Two basic models for analyzing Input Output tables are the Leontief (1936) and Ghosh (1958) approaches. The former approach is demand driven while the latter is supply driven. In details both models are built as follows.

$$X_i = \sum X_{ij} + F_i \ ,i= 1,2,3.....n \quad (1)$$

where $X_{ij}$ is the output of sector i consumed by sector j ,to all types of consumption and for final consumption denoted as $F_i$. Further the proportion of each input to the output of sector j is denoted by

$$a_{ij}=X_{ij}/X_j \quad (2)$$

$a_{ij's}$ are called structural or technical coefficients and give the direct input requirement of the ith sector for producing one unit of output of jth sector excluding the indirect effects involved in production process.

Further, equation (1) can be written as

$$X_i = \sum a_{ij}X_j + F_i \ ,i=1,2,3,.....n \quad (3)$$

In matrix notation equation (3) can be written as

$$X= AX + F \quad (4)$$

where A is the coefficient matrix obtained by dividing each element of the column of the flow matrix by the total input of the buying sector.

Further, equation (4) can be written as:

$$X= (I-A)^{-1} *F \quad (5)$$

where, $(1-A)^{-1}$is known as Leontief Inverse or matrix multiplier, gives both direct and indirect requirements of inputs. While direct inputs are those purchased by the sector under consideration, indirect inputs are those purchased by all other sectors in which production has to adjust in order to supply inputs to specific sector.

Similarly, the Ghosh model is a set of linear equations. By contrast it is given by:

$$X_J = \sum b_{ij}Xi + V_J \quad (6)$$

where $X_j$ is total input for activity j, $V_j$is the primary input (or the value added) of the same sector, and $b_{ij}$ is the output coefficient of sector j to sector i. Thus, in matrix form it can be represented as:

$$X'= (I-B)^{-1} *V \quad (7)$$

where $(I-B)^{-1}$ is called Ghosh inverse (Ghosh, 1958).

**Backward Linkages**

Backward linkage of the sector measures the inducement to production in other sectors which is absorbed as an input to the former. Two different approaches are found in measurement of linkages are discussed as follows. Chenery and Watnabe (1958) propose to use the column of the technical coefficients matrix A as a measure of backward linkage.

$$BL_j= \sum X_{ij}/X_j= \sum_i a_{ij} \quad (8)$$

where$X_{ij}$ represents the number of units of commodity i used in production of $X_j$ units of commodity j. The values of $a_{ij}$ are obtained from technical coefficient matrix A.

A total measure of backward linkages including both direct and indirect effects has been suggested by Rasmussen (1956).The index proposes to measure total backward linkages (direct plus indirect) obtained by summing over the columns of the inverted (I-A) matrix (Miller and blair 2009).It is called output multiplier.

$$DIB_j = \sum^N_{i=1} A_{ij} \quad (9)$$

where,$A_{ij}$ denotes the elements in the cell of inverted Leontief matrix The inter-sectoral comparison of Backward linkages can be made by constructing an index of backward linkage which can be represented as

$$U_j = (1/N) \sum_i A_{ij}/(1/N^2)\sum^N_{j=1} A_{ij} \quad (10)$$

where, the numerator represents the average of direct and indirect needs to meet the increases of final demand by one unit from sector j products, whereas the denominator refers to average total needs in economy to meet the increased of final demand by one unit , means, the aggregation of increased final demand in all sectors is one unit.

**Forward Linkages**

Forward linkage of a sector measures the extent to which the sector provides inputs for utilization by other sectors. Chenery and Watnabe (1958) propose to use the row sum of the technical coefficients matrix A as a measure of backward linkage.

$$FL_j = \sum X_{ij}/X_I = \sum_i b_{ij} \quad (11)$$

According to Jones (1976), Ghosh supply driven model is useful in estimating forward linkages and thus suggests to utilize the Ghosh inverse,$(I-B)^{-1}$ for the calculation of forward linkages. He argues that measurement of both backward and forward linkage by using Leontief inverse lead to a problem of double counting and thus should be avoided. Thus, summing of the rows of the inverted (I-B) give forward (direct plus indirect) linkages:

$$DIF_i = \sum^{N}_{j=1} B_{ij} \quad (12)$$

where, $B_{ij}$ are cell elements of inverted Ghosh matrix. This measure is equivalent to input multiplier (Miller and Blair 2009).

To facilitate the inter-sectoral comparison, Rasmussen's (1956) proposes to normalize the forward linkages based on Ghosh inverse correspondingly:

$$Ui = (1/N) \sum_i B_{ij}/(1/N^2)\sum^{N}_{i=1} B_{ij} \quad (13)$$

where, the numerator refers to average of the total of row which belongs to i sector in inverse Leontief matrix output , which measures the total impact on sector i, when the final demand grows for all sectors by one unit, the increase in investment in sector i will motivate the production of sectors which used the products of this sector. Whereas, the denominator states the average of averages for all the sectors.

**ANNEXURE**

**Table 1. Results obtained from Input Output Analysis**

| S.No | Sectors | Direct Backward Linkage | Direct Forward Linkage | Total normalized Backward Linkage | Total normalized forward linkage | Output Multiplier | Input Multiplier |
|---|---|---|---|---|---|---|---|
| 1 | Agriculture* | 0.4678 | 0.5074 | 1.0097 | 1.0148 | 1.8074 | 1.8174 |
| 2 | Animal husbandry | 0.3883 | 0.3632 | 0.9214 | 0.9042 | 1.6494 | 1.6192 |
| 3 | Forestry ,logging and fishing | 0.1512 | 0.4420 | 0.6972 | 0.8970 | 1.2480 | 1.6064 |
| 4 | Mining and Quarrying | 0.2291 | 1.1170 | 0.7619 | 1.5200 | 1.3638 | 2.7220 |
| 5 | Manufacturing | 0.3943 | 0.2397 | 0.8924 | 0.7819 | 1.5974 | 1.4001 |
| 6 | Construction | 0.1986 | 0.1964 | 0.7261 | 0.7157 | 1.2997 | 1.2817 |
| 7 | Electricity and Water supply** | 0.5879 | 1.0295 | 1.0876 | 1.5689 | 1.9468 | 2.8096 |
| 8 | Transport** | 0.5402 | 0.5824 | 1.0589 | 1.0772 | 1.8954 | 1.9290 |
| 9 | Storage and warehousing | 0.4421 | 0.9870 | 0.9798 | 1.5470 | 1.7538 | 2.7703 |
| 10 | Communication | 0.2466 | 0.9568 | 0.7804 | 1.4458 | 1.3969 | 2.5891 |
| 11 | Trade | 0.1973 | 0.5092 | 0.7389 | 0.9896 | 1.3226 | 1.7722 |
| 12 | Hotels and restaurants** | 0.6883 | 0.4529 | 1.1937 | 1.0224 | 2.1367 | 1.8309 |
| 13 | Banking | 0.1722 | 0.7293 | 0.7120 | 1.2121 | 1.2745 | 2.1707 |
| 14 | Insurance | 0.0578 | 0.1669 | 0.6128 | 0.7062 | 1.0969 | 1.2647 |
| 15 | Ownership of dwellings | 0.0848 | 0.0000 | 0.6341 | 0.5584 | 1.1351 | 1.0000 |
| 16 | Education and research | 0.1134 | 0.0560 | 0.6639 | 0.6090 | 1.1883 | 1.0906 |
| 17 | Medical and health | 0.3782 | 0.0444 | 0.9180 | 0.5954 | 1.6432 | 1.0662 |
| 18 | Business services** | 0.4945 | 0.9872 | 1.0349 | 1.5102 | 1.8524 | 2.7045 |
| 19 | Other services | 0.2655 | 0.2344 | 0.7938 | 0.7673 | 1.4208 | 1.3741 |
| 20 | Public administration | 0.0000 | 0.0000 | 0.5587 | 0.5584 | 1.0000 | 1.0000 |

Source: Author's estimation by using I-O table for 2007-08 in CSO (2012).

**Multiplier effects**

The output multipliersof sector j are calculated with the help of column sums of Leontief Inverse matrix that is $(I-A)^{-1}$ and can be used to determine the overall economic effects of spending one additional monetary unit of public expenditure on theoutput of the particular sector (Miller and Blair 2009) whereas input multipliers of sector i are calculated with the help of row sums of Ghosh inverse that is $(1-B)^{-1}$.

The input multipliers shows the effect on total output in all sectors of the economy associated with an additional unit of primary inputs in a particular sector.

**Identifying key sectors of the economy**

Now, both normalized backward linkage and normalized forward linkage are used to identify the key sectors of the Indian Economy. According to Hirschman, ideally the priority sectors in which investment is to be concentrated are those with high values of backward and forward linkage effects. Thus, in normalized form, sectors with backward and forward linkages greater than one are considered key sectors.

## RESULTS

The results of the linkage measures and input output multiplier are presented in Table 1. In terms of direct backward linkage, hotels and restaurants have highest backward linkage. For a unit increase in the output of the hotels and restaurants, electricity and water supply, transport, business services, the additional demand created for output in other sectors ranges from 49 percent to 68 percent. Whereas insurance, education and research, ownership of dwellings, Banking increased account for 5 percent to 17 percent increase in the output of other sectors. In terms of Direct forward linkage we find that electricity, water supply, business services, storage and warehousing and communication input contribution to other sectors ranges from 102 percent, 98 percent, 98 percent and 95 percent, for a unit increase in demand in rest of the economy. The results are further emphasized when we normalize the total linkages in order to illustrate the power of dispersion. According to this index, Hotels and restaurants, electricity and water supply records highest and second highest position in terms of total backward linkage. Thus both sectors relative extent to generate additional demand throughout the inter-industry system for one unit increase in their final demand is substantial.

Whereas for forward linkages same results hold but one thing to note is that the normalized backward linkage for most of the services are less than the normalized forward linkage, revealing that service sector has inducing impact on the rest of the economy. From Table 1, it has been found that hotels and restaurants, electricity and gas, transport, business services have high output multipliers while in terms of input multiplier mining and quarrying, electricity and water supply business services, storage and warehousing, communication record higher values than others. Sectors that record both low input and output multipliers include research, insurance, banking, trade ownership and dwellings, medical and health.

The results also reveals an important finding that although medical and health sector doesn't make to the sectors with both high direct and normalized backward and forward linkages but it holds good prospects for the economy since apart scoring well in input and output multipliers, its relative extent in terms of generating demand in other sectors is near to one if not one. Thus, the key sectors of the economy among services on the basis of high normalized backward and forward linkages are electricity and water supply, transport, hotels and restaurants and business services

## DISCUSSION

The purpose of the study has been to examine the indirect contribution of the services in terms of backward and forward linkages in the Indian economy and identify the key sub sectors within the service sector. Our findings, confirm the economic significance of the sector. The normalized backward linkage for most of the services are less than the normalized forward linkage, revealing that service sector has inducing impact on the rest of the economy and thus provision of services at cheaper rates will help those sectors which are interlinked with it. Although medical and health sector doesn't make to the sectors with both, high direct and normalized backward and forward linkages but it holds good prospects for the economy since apart scoring well in input and output multipliers, its relative extent in terms of generating demand in other sectors near to one if not one.

The key sub sectors of services identified are transport, hotels and restaurants and business services among others. One important think to note is that agriculture sector despite its low contribution towards real GVA holds special significance in the economy due to being induced and inducing growth (in terms of production) in other sectors of the economy. The findings further reveals that high dependence on service sector for achieving the growth targets could be misleading since the service sector is dependent on other sectors for input requirement as well as for supplying its output to others. Thus, in absence of the comprehensive development policy for all the sectors, the sector might face supply constraints and it would difficult for it to grow itself. The limitation of the study is that is pertains to a particular year that is 2007-08.There shortcoming of the input output exercise being carried out here is that, the input output table is only related to a particular year that is 2007-08.

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