Chapter III
Model and Methodology

As already said, in this work it has been broadly hypothesized that the liberalization, characterized by excessive and skewed tertiarization of the Indian economy, has its own consequences in terms of structure, linkage pattern and macro dynamics of the system. This requires analysis to be carried at both aggregate and a disaggregate level. Aggregate level analysis can sufficiently be handled using the data on gross domestic product and its components. For disaggregate level analysis of structural change and dynamics, there cannot be better option than the input-output formalism. Accordingly the current chapter first introduces the conceptual background; then the input-output model; and finally the methodological details.

3.1: Conceptual Background

Following is the review of various classifications of the tertiary sector so as to notice what constitutes the services sector. The analysis of services has suffered from definitional and classificatory problems. About five decades ago Stigler (1956) remarked that "There exists no authoritative consensus on either the boundaries or the classification of the service industries". Fuchs (1968), after making careful review of subsequent studies found no basis for challenging this conclusion.

Unfortunately no single, precise, unquestionable and unanimously acceptable definition of tertiary sector has emerged so far. In different empirical studies, this sector has been defined in
different ways. Even the definitions of this particular sector as given by the two-founding fathers of the three-sector model i.e., Fisher (1939) and Clark (1940) are not identical. The former defined tertiary sector as consisting of "transport, communication, trade, government, personal and domestic services and in some versions construction". On the other hand, the latter opines that this sector covers "all forms of economic activity not included under primary and secondary" and he later listed "distribution, transport, public administration, domestic services and all other activities producing a non-material output" as the principal tertiary activities.

Further, the inclusion and exclusion of certain activities like transport, communication and public utilities (i.e., electricity, gas and water supply) has also been a subject of controversy. Fuchs (1968) points out that while some writers like Ofer (1967) have included the foregoing activities in their studies, some others like Lengelle (1966), and Stigler (1956) have excluded these in their respective studies. Still there are others like Worton (1969) who have included in their study only the first two of these activities i.e., transport and communication and have excluded the third one i.e. public utilities. This composition of the sector was later used by Deakin and George (1965) and Dowie (1966) in their studies of service sector relating to U.K. and Australia respectively.

Besides, even within the work of single author variations in definitions can be noticed. In this context Fuchs (1968) quotes the example of Kuznets (1958) who included transportation, communications and public utilities in the service sector, but excluded these in his later work, viz. Modern Economic Growth (1966). In this he defined the service sector as comprising of
"trade, finance, real estate, personal, domestic, professional and government services" (Kuznets. 1966).

Foote and Hatt (1953) have suggested the classification of the service industries into three categories: tertiary, quaternary and quinary. In the first category they include domestic and quasi-domestic service i.e., restaurants and hotels, barber and beauty shops, laundry and dry cleaning establishments, repair and maintenance services and also handicrafts once performed at home. The quaternary category in their opinion is made up of finance, administration, transportation, communication and commerce. Their most noticeable characteristic being that these facilitate and effectuate the division of labour. They clubbed together activities such as health care, education and recreation (including the arts) in the quinary industry. They maintain that services rendered by this sub-sector are designed to change and improve the recipient in some way. The services rendered by the ‘tertiary industry' is intended to maintain the customers in the style to which they are accustomed to, but the services comprised in this sector are devoted to the cultivation of behaviour to which they are not accustomed to.

Katouzian (1970) has provided a classification of the service sector in which he analyses the growth pattern of this sector by dividing it into three categories: new services, complementary services and old services. According to him, new services are those which have experienced a great shift in demand with the advent of ‘high mass consumption’ and thereafter their consumption seems to be an increasing function of per capita income and leisure time. It included such sub-sectors of the economy as education,
consumption of modern clinical and medical services, entertainments in general (including holiday resorts, hotels and restaurants, etc.). In the complementary services, Katouzian includes services whose production normally takes a sharp turn with the rise of manufacturing production (i.e., the take-off of the rate of growth of output in general). It includes intermediary services like banking, finance, transportation, wholesale and retail trade which are of complementary nature to the production process. On the other hand, old services consist of those activities which flourished before industrialization and whose importance and contribution has almost continuously declined over time. The domestic services are included into this category.

Browning and Singlemann in Gershuny and Miles (1983) have offered an alternative classification of the tertiary sector in which they have divided service industry into four categories: viz., distributive, producer, social and personal services. They renamed the conventional primary and secondary sectors as 'extractive' and 'transformative'.

Some writers defined services in terms of their characteristics (Hill, 1977), some in the form of transactions involved (Sampson and Snape, 1985) and some others like Bhagwati in Giarani (1987) categorized these into groups. Inman (1985) has classified services on the basis of their characteristics into three categories viz., stagnant personal services, progressive impersonal services and asymptotically stagnant impersonal services.

Bhattacharya and Mitra (1997) in their study relating to
composition of tertiary sector in 48 developing and industrialized countries pointed out that the workers in a particular industrial division do not carry out a single type of activity. Therefore, they decomposed tertiary sector workers into four occupational categories depending upon the nature of activities they perform. They divided occupational classes into four major groups viz., bureaucratic services, distributive services, consumer services and producer services.

In the World Trade Organization (WTO) classification, the services have been classified into following 12 sectors as given below in Table 3.1.

**Table 3.1: Classification of service sector under World Trade Organization**

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>1.</td>
<td>Business including professional and computer services</td>
</tr>
<tr>
<td>2.</td>
<td>Communication including telecom, postal and courier services</td>
</tr>
<tr>
<td>3.</td>
<td>Construction and related engineering services</td>
</tr>
<tr>
<td>4.</td>
<td>Distribution services</td>
</tr>
<tr>
<td>5.</td>
<td>Educational services</td>
</tr>
<tr>
<td>6.</td>
<td>Environmental services</td>
</tr>
<tr>
<td>7.</td>
<td>Financial including insurance and banking services</td>
</tr>
<tr>
<td>8.</td>
<td>Health related and social services</td>
</tr>
<tr>
<td>9.</td>
<td>Tourism and trade related services</td>
</tr>
<tr>
<td>10.</td>
<td>Recreational, cultural and sporting services</td>
</tr>
<tr>
<td>11.</td>
<td>Transport services</td>
</tr>
<tr>
<td>12.</td>
<td>Other services not included elsewhere</td>
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</tbody>
</table>


Thus, the brief review of the definitions of the tertiary sector confirms the fact that due to lack of universally accepted theoretical framework for defining services considerable ambiguity still prevails concerning this concept. There obviously arises a need
for some standard classification which should not only promote the uniformity and standardization in accounts, but should also improve the reliability of comparative data. These above-mentioned points formed the main objectives of the United Nations system of national accounts when United Nations entered the field of national income accounting after World War II. The UN System of national accounts recommends that for preparing national income statistics all the economic activities of the nation should be classified according to the International Standard Industrial Classification of economic activities which is shown in Table 3.2.

Table 3.2: United Nations classification of economic activities

<table>
<thead>
<tr>
<th>Sector</th>
<th>Economic activity</th>
<th>International Standard Industrial Classification</th>
</tr>
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<tbody>
<tr>
<td>Primary</td>
<td>Agriculture, hunting, forestry, fishing</td>
<td>1</td>
</tr>
<tr>
<td>Secondary</td>
<td>Mining and quarrying, manufacturing, electricity, gas, water; construction</td>
<td>2-5</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Wholesale and retail trade, restaurants and hotels; transport, storage and communication; financing, insurance, real estate and business services; community, social and personal services; activities not adequately defined.</td>
<td>6-0</td>
</tr>
</tbody>
</table>


In the National Income Accounting of India, the tertiary sector includes categories as shown in Table 3.3.

Table 3.3: Tertiary sector in Indian national income accounting
1. Trade, hotels, transport and communication
   (i) Trade
   (ii) Hotels and restaurants
   (iii) Railways
   (iv) Transport by other means
   (v) Storage
   (vi) Communication

2. Financing, insurance, real estate and business services
   (i) Banking and insurance
   (ii) Real estate, ownership of dwellings and business services

3. Community, social and personal services
   (i) Public administration and defence
   (ii) Other services


So it is quite obvious from the above discussion that services comprise of many diverse and heterogeneous activities, therefore, arriving at a precise and universally acceptable definition appears to be an uphill task. Since ICT driven globalization, WTO and GATS have further widened the scope of services to include new services also as a consequence of which the task appears to be even more difficult.

Still, we may conclude that service sector comprises a wide spectrum of low productivity activities (mainly in the informal sector like repair and maintenance services, transport, shoe-shine, cobblers, hawkers, personal services like hairdresser, washer man etc.) and high productivity activities (mainly professional, legal etc.) and new services like software, IT (internet), IT enabled services (i.e., call centres, design, business process outsourcing), cellular phone services (telecommunication), ATMs, credit cards etc. (financial services) as well.

3.2: Model and Methodology

The input-output system is a convenient means of representing a huge mass of data into a coherent whole such that
the structural relationships underlying the economy are meaningfully revealed. A simple Leontief system can be described in terms of a set of simultaneous linear equations as follows:

\[ X_i = \sum_{j=1}^{n} X_{ij} + C_i \quad (i = 1, 2, \ldots, n) \]  

(1)

Where \( X_i \) stands for the gross of output the \( i \)th industry, \( X_{ij} \) is the output of the \( i \)th industry used as input in the \( i \)th industry and \( C_i \) denotes output of industry \( i \) available for outside consumption or final demand. Equation System (1), known as the balance equations, shows that the total gross output of a commodity is equal to inter-industrial requirement and outside consumption which may comprise of household and government consumption, capital formation and not foreign trade. If we postulate that every commodity is produced by only one given process, then \( X_{ij} = a_{ij} \bar{X}_j \) \((i, j = 1, 2\ldots n)\); where \( a_{ij} \) stands for the amount of the \( i \)th commodity used as an input for production of one unit of \( j \)th commodity. We can rewrite the system of equation (1) as:

\[ X_i = \sum_{j=1}^{n} a_{ij}X_j + C_i \quad (i = 1, 2, \ldots, n) \]  

(2)

Equation system (2) constitutes the fundamental relationship of a simple Leontief system. It is instructive to remark on the various assumptions implied in this set of relations. It is a multisectoral model or an economy which is divided into number of sectors and involving no joint production. It assumes one process per commodity and uses constant input coefficient. Such an assumption, apart from making the model analytically more manageable, enables us to have a one to one correspondence
between industries and products.

To make the exposition clearer we could present the input-output schemata in a tabular form as follows:

**Table 3.4: System of balance equations of an economy**

<table>
<thead>
<tr>
<th>Industries to 1</th>
<th>2</th>
<th>3</th>
<th>n</th>
<th>C</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
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<tr>
<td>1.</td>
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<tr>
<td>2.</td>
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<td>3.</td>
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<tr>
<td>n</td>
<td></td>
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</tr>
</tbody>
</table>

The row-wise addition of all the inter-industry demands $X_{ij}$’s and the final demand $C_i$ as shown above, gives the corresponding gross output $X_i$, each row thus yielding the balance equation of an industry. Looked at column wise we obtain the input structure of an each of the industries. For example, in industry 2, $X_1$ amount product one; $X_{22}$ amount of product two and so on, will be used as inputs to produce $X_2$ amount of output. When column wise entries for a particular industry are divided by the gross output figure of the corresponding industry we get the input coefficients of that industry. Again considering the industry number 2, we can obtain $X_{12}/X_2$ as an input coefficient of product one in industry two. This coefficient is denoted by $a_{12}$. By similar operations, we can obtain a table of coefficients comprising of the first n columns of table 1. The Input coefficients Matrix would appear as follows:
The basic input relations could then be rewritten compactly as,

\[ A X + C = X \]  \hspace{1cm} (3)  
\[ (I-A) X = C \]  \hspace{1cm} (4)

Where \( A \) is the matrix of coefficients  
\( X \) is a vector of gross outputs and  
\( C \) is a vector of final demand

It is obvious from the above that once we have the matrix \( A \) and the vector of total output \( X \) we can easily commodity available for final use. Similarly, when \( A \) and \( C \) are given we could solve for \( X \). While such a result would be just tautological for the year for which the table is constructed, it would be substantive when we have to compute such as information for some other specified period. This, of course assumes the matrix \( A \) to be the same in the two periods. Thus, given

\[ (I-A) X = C \]  \hspace{1cm} (5)

for some base year, and also the sector of gross output, \( X \) for some other specified period, we could easily obtain the corresponding \( C \). Similarly, by multiplying throughout \((I-A) X=C\) by \((I-A)^{-1}\) we could obtain for specified \( C \) the compatible levels of various \( X_{ij} \)’s as follows:
\[ X = (I-A)^{-1} C \]

It may be noted that the entries in the set of balance equations are in appropriate physical units. When we derive from the table of balance equations the table of coefficients, \( A \), we divide the column by the gross outputs of the relevant industry. Naturally, the various inputs and outputs may be in different units; therefore, the coefficient \( a_{ij} \) are expressed as \( a_{ij} \) units of commodity \( i \) per unit of commodity \( j \); these two units being different. For example, in cloth industry it will be \( a_{ij} \) bales of cotton per yard of cloth.

The inter-regional and inter-temporal comparisons of input-output tables have been attempted in recent years and techniques of analysis have been developed, to explore structural change with a view to establish meaningful relationship between the overall degree of industrialisation and its pattern. Even in timeframe the basic approach is that of 'comparative statistics' in general, and is confined, in particular to Leontief static model in the input-output framework. Comparisons relate to the following aspects of the input-output model: (a) the overall comparison of the structure of production on the basis of input-output coefficient matrices; (b) comparison of individual input-output coefficients; and (c) overall comparison of direct and indirect effects based on the Leontief inverse of the \( A \) matrix i.e. \((1-A)^{-1}\).

Another approach is to estimate the service intensities. The service intensity can be evaluated following various alternative methodologies. Given the fact that demand for services is derived from the output depending on the purpose for which services is
used as an indicator. It can be defined using terms like gross services intensity, net services intensity, industrial services intensity, manufacturing services intensity, non-manufacturing services intensity and the end use services intensity. Here two basic types of services intensity can be defined. The first type imputes productive services use, i.e., $S_{\text{ind}}$, to total output of economy X. The second type imputes productive services use i.e., $S_{\text{ind}}$ to final demand F.

For structural change, we have used the coefficient level comparisons. As a proxy to service intensities, we have used the service input coefficients at a disaggregate level. For analysis of linkage patterns both backward and forward linkages have been evaluated using the A coefficients matrix only.

A widely used technique to identify the relative contribution of different determinant of the structural economic change (output growth) is input-output Structural Decomposition Analysis (SDA). The input-output SDA decomposes macro output growth into the relative contribution of changes in technology coefficient and changes in the patterns of final domestic and foreign demand. The SDA is based on an accounting identity the basic material balance equation, which decomposes the output growth, is as follows:
\[ Q_i = C_i + (X_i - M_i) + \sum_j Q_{ij} \]

Where \( Q_i \) = gross output of sector i 
\( C_i \) = domestic final demand (consumption plus investment) 
\( (X_i - M_i) \) = net trade (exports minus competitive imports) 
\( \sum_j Q_{ij} = \sum_j a_{ij} Q_j \) = intermediate use of commodity i by sector j 
\( \{a_{ij}\} \) = input-output coefficients

Equation 6 shows the basic identity for decomposition of output growth. Its components are as follows:

a) *Domestic Final Demand*: that is output changes directly imputable to changes in the levels of final (private and public) consumption. This component accounts, therefore, the direct impact of increase in consumption, due to both general shifts in patterns of taste and preference as well as income elasticities of final demand and increasing levels of public procurement of different sectors output.

b) *Export Expansion*: that is output growth mainly pulled by shifts in foreign demand (net of imports). This component accounts for positive shifts in international comparative advantage in favour of some of the service sectors, which are becoming increasingly tradable in international market.

c) *Intermediate Demand or technological change*: That is output growth due to changes in the intermediate demand per unit of output, or changes in Leontief inverse matrix of technology coefficient. This component captures changes in organization of production in the sectors, implying an increase in the intensity of demand for some intermediate inputs.
d) *Technological change or intermediate demand* expansion due to change in input-output coefficients is the total effect on output from sector $i$ of the changing input-output coefficients throughout the economy as wages and income level rise.

The derivation of the four components of output growth has been done using the standard input-output demand decomposition analysis framework.

### 3.3: Sources of Data

Keeping in view the broad objectives of the study, the secondary data on the Indian economy has been used. For analysis of structure, the sector level data from ‘National Accounts Statistics’ (CSO) have been used. In addition, some individual service sector specific sub-sector departmental data sources also form the database of the study. The structural change has been analyzed with reference to sectoral shares, production structure, employment structure, input structure and some other key elements of structure. Using statistical techniques, the temporal and spatial dimension of the tertiarization have been explored. In order to analyze the production structure, the data has been obtained from various issues of Economic Survey of India for the year 1950-51 to 2006-07. The data for analyzing employment structure has been obtained from various rounds of National Sample Survey Organization for the year 1993-94, 2000-01 and 2004-05 respectively.

Since the study is based on Input-Output tables, so the Input-Output Transaction tables (IOTT) prepared by nation Accounts
Statistics (NAS) have been used. The selection of the years depends upon the availability of the Input-Output transaction tables. The first Input-Output Transaction Table (IOTT) for the year 1968-69 was published by the Central statistical Organization (CSO), in the publication “National Accounts Statistics, 1978”. This table was prepared jointly by the CSO and Planning Commission. Afterwards CSO prepared the IOTT tables for the year 1973-74 on its own and decided to continue the task of preparing IOTT on regular basis and publish them once in every five years. The detailed report entitled “Input-Output Transaction Table, 1973-74 “was published by CSO in September 1981. Thereafter, the reports of IOOTT for the reference years 1978-79, 1983-84, 1989-90, 1993-94 and 1998-99 were published in June 1989, September 1990, November 1997, July 2000 and March 2005 respectively. Latest IOTT is available for the year 2003-2004.

To analyze the linkage patterns and the underlying dynamics, a series of input-output tables for the year 1968-69, 1973-74, 1978-79, 1983-84, 1989-90, 1993-94, 1998-99, and 2003-04 have been used. Wherever needed, appropriate price adjustments and data refinements have been done. Keeping in view the objectives of study and the consistency aspect of data availability, the work covers the period through 1968-69 to 2003-04. In order to analyze the above data, tabular analysis has been supported by percentages, averages, growth rates and measures of forward and backward linkages.

To sum up we can say the methodological approach of the work is a hybrid of input-output approach and the aggregate analysis approach.