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INTER-INDUSTRY LINKAGES OF HOUSING
INVESTMENT IN INDIA

By
BAKUL H. DHOLAKIA

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I

INTRODUCTION

Housing represents one of the important sectors of national economy. It plays a significant role in promoting economic growth and improving the general level of social well-being. Provision of adequate housing produces multifarious effects in the national economy mainly in the form of direct and indirect income generation, direct and indirect employment generation and improvement in productivity levels, besides serving also as a means of increased social welfare.

The total impact of housing investment on the process of income generation and economic growth extends

much beyond what may be called the initial or direct effect, because housing investment generates significant growth impulses in the economy which are transmitted from one sector to another. The extent of inter-sectoral transmission of growth impulses depends on the nature and strength of inter-industry linkages of housing sector with the rest of national economy. It is evident, therefore, that to evaluate the overall impact of housing investment on the national economy, it is necessary to estimate the intersectoral linkages and the overall output expansion resulting from the additional expenditure on housing. Moreover, from the viewpoint of policy makers, the decision regarding additional investment in housing is closely related to the overall impact not only of housing investment but also of investment in other alternative fields.

Thus, the optimal allocation of scarce national resources involving housing vis-a-vis other sectors can be determined only after a comparative evaluation of the intersectoral linkages of investment in housing and other sectors in the economy. The present paper makes an attempt in this direction. It seeks to measure the total direct and indirect output generation impact of additional expenditures

on various sectors of Indian economy and to assess the relative importance of housing investment in the context of assigning priority for resource allocation.

The paper is divided into six sections. The first section is of introductory nature. The second section discusses the methodology of analysing the inter-industry linkages, while the third section examines the nature of input-output data available for Indian economy. The fourth section is devoted to an analysis of the inter-industry linkages of construction vis-a-vis other sectors. The fifth section examines the relationship between housing expenditure and sectoral growth. The sixth and final section summarises the main conclusions emerging from the analysis presented in earlier sections.

II

THE METHODOLOGY

The concept of inter-industry linkages involves an attempt to trace the flow of various types of materials and their product through different stages of production in

order to determine the quantities and the disposition of inputs consumed while supplying finished products to final demand activities. The final demand activities are defined in terms of activities other than production and include private consumption, government consumption, private investment, public investment, change in inventories and the demand for exports from the foreign sector net of imports.

The crucial element in inter-industry linkages is the phenomenon of inter-dependence of production activities which arises from the fact that each production activity requires the output of several other production activity in the form of inputs. Accordingly, a given sector depends on those sectors which supply inputs to it and also on those which use its output as their inputs. It follows, therefore, that the expansion of a given sector generates additional demand for the output of its input-supplying sectors and also simultaneously provides larger supply to its output-using sectors. According to the conventional classification of inter-industry linkages, the former type of inter-dependence is called the backward linkage while the latter is called the forward linkages.

It is customary to use the methods based on Leontief's input-output analysis to quantify the extent of inter-sectoral linkages.*1 Leontief's input-output table is a useful device of summarising the origin of each of the various inputs and the destination of each of the various outputs of all industries in an economy. It shows the inter-industry transactions in the form of flow of goods and services. Assuming that there are n sectors in the economy, we can denote the gross output of the j^{th} sector by X_j and the amount of i^{th} sector's output consumed in the process of producing j^{th} sector's output as X_{ij} . The matrix X consist of elements X_{ij} ($i = 1, 2, \dots, n$; and $j = 1, 2, \dots, n$) represents the input-output transactions matrix of dimension $n \times n$. From the transactions matrix, we can derive the technology matrix A by defining the technical input-output coefficient $A_{ij} = \frac{X_{ij}}{X_j}$. The coefficient A_{ij} indicates the amount of i^{th} sector's output required as input for producing one unit of the j^{th} sector's output.

*1 Leontief's pioneering work in the field of input-output analysis is contained in the following studies: i) W.W. Leontief, The Structure of American Economy, 1919-1939, Oxford University Press, 1941 and (ii) W.W. Leontief, Input-Output Economics, Oxford University Press, 1966.

The output of any given industry is used partly to meet the inter-industry demand and partly to meet the final demand. Accordingly, we have the following basic identity indicating how the i^{th} sector disposes of its output:

$$\sum_{j=1}^n X_{ij} + F_i = X_i \quad (i = 1, 2, \dots, n)$$

Where $\sum_{j=1}^n X_{ij}$ shows the total use of i^{th} industry's output by each of the n sectors;
and F_i shows the final demand for the product of i^{th} sector.

In matrix notation, the system of equations implicit in the above identity can be expressed as

$$AX + F = X \quad \dots \quad (1)$$

Equation (1) can also be re-written as

$$X - AX = F$$

i.e., $(I-A)X = F$ where I represents the identity matrix of dimensions $n \times n$.

Pre-multiplying both sides of the above equations by $(I-A)^{-1}$, we get

$$X = (I-A)^{-1} F \quad \dots \quad (2)$$

In the open Leontief system, the final demand vector F is given exogenously. We can, therefore, raise the following question: Given the final demand for various goods and services, what should be the level of gross output that each sector will have to produce to meet the final demand? The levels of gross output that will exactly meet the final demand for various goods and services will be the ones that will also support all the production activities required in producing various types of output consistent with the given technology of production indicated by the technical input-output coefficients. As shown in equation (2), these equilibrium output levels can be readily obtained once we have the inverse matrix $(I-A)^{-1}$, also known as the 'Leontief Inverse'.

The elements of the Leontief Inverse have special interpretation. Let the elements of the inverse matrix $(I-A)^{-1}$ be denoted by C_{ij} , $i = 1, 2, \dots, n$; and $j = 1, 2, \dots, n$. The elements of j^{th} column ($C_{j1}, C_{j2}, \dots, C_{jn}$) indicate the gross output from each of the n sectors required to meet one unit of final demand for the product of j^{th} sector. It is evident that to produce one unit of final output of a given sector, inputs are required from various sectors.

It is necessary, therefore, to produce some output in each of the different sectors to support one unit of final output of a given sector. The necessity to produce some positive output levels in other sectors in turn implies further requirements of the output of various sectors to serve as inputs in each sector's output. The total output requirements for all sectors taken together of producing one unit of final output of a given sector would thus consist of the direct and indirect output requirements. The elements of a given column vector of the inverse matrix $(I-A)^{-1}$ represent the levels of direct and indirect output in various sectors associated with one unit of final demand for the output of the corresponding sector.*²

*²For a general discussion of the input-output technique and the exposition of a general framework of input-output analysis, see: (i) Dorfman, Samuelson and Solow: Linear Programming and Economic Analysis, McGraw Hill, New York, 1958; (ii) H.B. Chenery and P.G. Clark; Inter-industry Economics, John Wiley and Sons, New York; 1958; and (iii) Chiou-Shuang Yan: Introduction to Input-Output Economics, Hov, Rinchart and Winston, New York, 1969.

Measures Of Inter-Industry Linkages:

Given the technology matrix A and the inverse matrix $(I-A)^{-1}$, we can measure the strength of different types of inter-industry linkages. The following four measures are widely used for this purpose:

- 1) The first measure indicates the direct backward linkage representing the direct input demand generated by a unit change in the level of production of a given sector. This measure is known as the coefficient of backward linkage or BL_i . The coefficient of direct backward linkage associated with the expansion of sector j is measured by:

$$BL_i = \frac{\sum_{i=1}^n X_{ij}}{X_j} = \begin{array}{l} \text{Direct intermediate input} \\ \text{requirement of sector } j \\ \text{per unit of its gross output} \end{array}$$

- 2) The second measure indicates the direct forward linkage between a given sector and the rest of the economy. This measure is known as the coefficient of forward linkage or FL_i . The coefficient of direct forward

linkage for sector i associated with the expansion in the output of all sectors is measured by:

$$FL_i = \frac{\sum_{j=1}^n X_{ij}}{X_i} = \text{Proportion of } i^{\text{th}} \text{ sector's output indicating direct requirement of its output for maintaining the output levels in all sectors.}$$

- 3) The third measure indicates the total impact of an increase in the output of a given sector on all sectors taken together. This measure, known as 'total linkage coefficients' or the 'index of power on dispersion' (Y_j) accounts for the direct as well as indirect linkages induced via feedbacks and spillovers of the initial impact to all other sectors in the economy. The total linkage coefficients associated with the expansion of sector j is measured by:

$$Y_j = \frac{\sum_{i=1}^n \sum_{j=1}^n C_{ij}}{\sum_{i=1}^n \sum_{j=1}^n C_{ij}} = \text{Total direct and indirect requirements of inputs per unit of final demand of sector } j$$

4) The fourth measure indicates the total of direct and indirect inducements received by a particular sector as a result of changes in the final demand levels of other sectors. This measure is known as 'the coefficients of total linkage receipt' or the 'index of sensitivity of dispersion' (Z_i). The coefficient of total linkage receipt is measured by:

$$Z_i = \frac{\sum_{j=1}^n C_{ij}}{\sum_{j=1}^n \sum_{i=1}^n C_{ij}} = \text{Total direct and indirect requirement of the output of sector } i \text{ per unit of final demand in each sector.}$$

Limitations Of Input-Output Analysis:

The methodology of input-output analysis depends on some crucial assumptions regarding the nature of input-output relations. For instance, the use of technical input-output coefficients derived from the inter-industry transactions matrix assumes that any given change in the level of output is accompanied by a proportionate change in the amounts of all inputs required in the process of production. This is known as assumption of fixed input-coefficients of

production which implies that there are constant returns to scale in transforming the basic inputs into final output, and that different industries are operating under the conditions of competitive equilibrium. In reality, however, the input-output coefficients may undergo some changes with the passage of time on account of changes in the basic technology of production or changes in the relative prices or the existence of economies of scale. Moreover, an analysis of inter-industry linkages based on the given input-output table concentrates only on the production linkages and examines the impact of changes in sectoral outlays on output levels. In the process, it usually abstracts from the kinds of effects it may have on the distribution of purchasing power among different categories of consumers.

In addition to this, there are many practical difficulties in data compilation and empirical derivation of the input-output table especially for an under-developed economy. However, notwithstanding the limitations, the input-output analysis is widely used mainly because it remains the only powerful device available for estimating the inter-industry linkages and conducting impact analysis of policies relating to resource allocation.

INPUT-OUTPUT DATA FOR INDIAN ECONOMY

During the last two decades considerable research work in the field of input-output economics involving empirical construction and analysis of input-output tables relating to Indian economy has been carried out.*³ The information on inter-industry transactions depicted by the input-output tables has been extensively used in the formulation of India's five year plans. The econometric model adopted in the approach paper for the Fifth Five Year Plan integrated in it a fairly detailed input-output model based on a fairly detailed input-output table compiled for the year 1973-74.*⁴ The input-output table prepared by the planning commission for the year 1973-74 consists of 66 sectors and represents a revised and up-dated version of the inter-industry transactions matrix originally compiled for the year 1965-66.

The approach paper for the Fifth Five Year Plan gives the technical coefficients matrix indicating the total input requirements and also the import coefficients matrix indicating the import requirements per unit of a

*³For a comprehensive review of the input-output research work in India, see M. Mukerjee: On the Construction and Use of Interindustry Transactions Tables in India, Arthavijnana, Vol. 9, Nos. 3-4, September-December 1967

*⁴A Technical note on The Approach to the Fifth Plan of India, 1974-79, Planning Commission, Government of India, April 1973.

given industry's output. Both the total coefficients matrix as well as the import coefficients matrix show input requirement per rupee of gross output at factor cost at 1971-72 prices. From the information provided by these matrices, we can derive the intra-regional or domestic technology matrix whose elements indicate the supply of inputs from within the country per unit level of output of a given sector in the country.

It is necessary to subtract the import transactions from the total transactions and focus mainly on the resulting matrix of domestic transactions because imports represent leakages from the incremental inter-sectoral flows generated by the expansion of a given sector. The strength of direct as well as indirect growth impulses originating from a unit increase in the final demand for the product of any sector is reduced in proportion to the direct and indirect input requirements to support the expansion of various sectors needed to meet the increased demand. For the purpose of the present analysis, we have therefore used the domestic technical coefficients matrix to measure the direct and indirect measures of increased expenditure in a given sector on the domestic output levels of various

sectors. Accordingly, the modified version of the basic identity that we have used for analysing inter-industry linkages in Indian economy is the following:

$$X + MX = AX + F \quad \dots \quad (3)$$

where X represents the vector of domestic output levels with dimension $1 \times n$

M represents the import coefficients matrix of the dimension $n \times n$

A represents total technical coefficients matrix of the dimension $n \times n$

F represents the final demand vector with dimensions $1 \times n$. It includes private consumption, public consumption, gross fixed investment, exports and change in stock.

Equation (3) can be re-written as:

$$X + MX - AX = F$$

i.e. $(I + M - A)X = F$

Pre-multiplying both sides of the above equation by $(I+M-A)^{-1}$ we get

$$X = (I + M - A)^{-1} F \quad \dots \quad (4)$$

The elements of each column of $(I+M-F)^{-1}$ indicate the direct and indirect domestic output levels in different sectors required to support a unit increase in the final demand for the product of the corresponding sector.

Sectoral Classification:

The broad sectoral classification of the 66 sectors in the input-output table prepared by the Planning Commission for the year 1973-74, is as follows:

<u>Broad Sectoral Category</u>	<u>The extent of Disaggregation as indicated by the number of sectors considered</u>
1) Agriculture and Allied Activities	5
2) Mining	4
3) Manufacturing	52
4) Electricity	1
5) Construction	1
6) Transport	2
7) Services including Communication, Banking, Insurance, Trade, Professional Services etc.	1
TOTAL :	<u>66</u>

It is evident from the above classification that the main emphasis in preparing the input-output table for Indian economy is essentially on depicting the inter-industry transactions and commodity balances largely within the manufacturing sector. Two types of factors seem to account for this phenomenon: (a) the non-availability of the basic statistical source material required for preparing reliable input-output coefficients at disaggregated levels for sectors other than agriculture and manufacturing; and (b) the need to focus mainly on the overall commodity balances within the framework of a consistency model for formulating the five year plan.

From the viewpoint of the present analysis, the pattern of sectoral classification revealed by the 66 x 66 sector input-output table for the Indian economy indicates major imbalances in the levels of disaggregation attempted within different sectors. Such imbalances would affect the estimates of inter-industry linkages for different sectors. If the analysis of inter-industry linkages is to provide meaningful information for determining the relative allocation of resources among the different sectors, it is

necessary that the overall sectoral classification is based on a more or less similar degree of aggregation within each broad category of sectors.

The framework of aggregative sectoral classification based on the broad spheres of economic activity seems to be more appropriate for analysing the inter-industry linkages to formulate resource allocation policy. Moreover, to make the comparison of the overall impact of additional expenditure in each of the alternative sectors effective and meaningful, it is necessary that the final expenditure levels in those sectors are high enough to absorb substantial expansion. Over a narrow time horizon, the possibilities of increasing the final demand expenditures in various sectors are limited essentially by the existing levels of final demand expenditures in the respective sectors. For instance, if the total final expenditure on the output of the sector Watches and Clocks, is only Rs. 11 crores in 1973-74, it is difficult to envisage an additional expenditure of the order of Rs. 100 crores on this sector in the near future. Thus, while analysing and comparing the extent of inter-industry linkages of various sectors, the relative importance of each sector in the national economy

as indicated by its contribution to the aggregate final demand needs to be considered.

For the purpose of the present study, we have aggregated the detailed 66 x 66 sector input-output table prepared by the Planning Commission for the year 1973-74 (of the total coefficients as well as of the import coefficients) into the corresponding 20 x 20 sector tables by adopting the usual procedures of aggregation. The major part of the aggregation relates to the manufacturing sector which accounts for 52 of the 66 sectors distinguished in the original table. In the aggregated table that we have prepared, the manufacturing sector is represented by 13 sectoral categories, the remaining seven sectors being agriculture and allied activities, mining, electricity, construction, railways, other transport, and other services including communication and business, insurance, trade and professional services.

The aggregated 20 x 20 sector total coefficients matrix as well as the corresponding import coefficients matrix that we have derived from the detailed input-output tables prepared by the Planning Commission for the year

1973-74 are presented in Appendix Tables 1 and 2 respectively. The relative importance of each of these 20 sectors in the Indian economy, as indicated by the contribution of each sector to the aggregate gross output and the aggregate final demand, is brought out by the estimates presented in Table 1.

It can be seen from Table 1 that in terms of the contribution to gross output as well as final demand, construction ranks third in the twenty sectors of the economy, agriculture and other services being the only two sectors ranking higher than construction. There are at least five sectors whose contribution to gross output as well as final demand is found to be less than one per cent, viz., mining, wood and wood products, paper and printing, leather and leather products and miscellaneous industries including repair services. In addition to these sectors, rubber, plastic and petroleum products, non metallic minerals and electricity are other sectors which contribute less than one per cent to the final demand, though their contribution to gross output exceeds one per cent. It is evident that the existing activity levels in these sectors are not high enough to absorb a significant proportion of the additional investment that can be made in the economy.

Table 1

Distribution Of Gross Output And Final Demand Among Different Sectors, 1973-74

Sector	Gross Output (In Rupees crores at 1971-72 prices)	Percentage Distribution of Gross Output	Final Demand (In Rupees crores at 1971-72 prices)	Percentage Distributi of Final Demand
1	2	3	4	5
1. Agriculture and Allied Activities	26283.04	39.21	19071.97	41.56
2. Mining	548.06	0.82	221.05	0.48
3. Food Products, Beverages And Tobacco	4139.41	6.17	3722.50	8.11
4. Textile Products	4153.67	6.20	3426.86	7.47
5. Wood and Wood Products	381.20	0.57	241.82	0.53
6. Paper And Printing	415.31	0.62	245.92	0.54
7. Leather And Leather Products	191.88	0.29	187.78	0.40
8. Rubber, Plastic And Petroleum Products	904.53	1.35	330.84	0.72
9. Chemicals	1906.22	2.84	541.42	1.18
10. Non-Metallic Minerals	1005.71	1.50	165.74	0.36
11. Basic Metals And Metal Products	2661.50	3.97	824.02	1.80
12. Non-Electrical Machinery	895.14	1.34	796.65	1.74
13. Electrical Machinery	968.11	1.44	647.40	1.41
14. Transport Equipment And Parts	1087.73	1.62	700.64	1.53
15. Misc. Industries Including Repair Services	482.96	0.72	455.80	0.99
16. Electricity	1025.30	1.53	201.08	0.43
17. Construction	4856.70	7.24	4185.65	9.12
18. Railways	1203.00	1.79	753.96	1.64
19. Other Transport	1476.90	2.20	916.93	2.00
20. Other Services	12454.30	18.58	8256.88	17.99
Total	67040.67	100.00	45894.91	100.00

IV

INTER-INDUSTRY LINKAGES OF CONSTRUCTIONVIS-A-VIS OTHER SECTORSMeasures of Direct Linkages:

Estimates of the coefficients of backward and forward linkages for various sectors computed from the 20 x 20 sector domestic transactions matrix^{*5} are presented in Table 2. It is evident from the figures given in Table 2 that there are wide variations in the relative strength of forward and backward linkages among different sectors. For instance, the coefficient of backward linkage varies from 0.8520 in the case of leather and leather products to 0.0464 in the case of other services. The coefficient of backward linkages of construction sector is found to be 0.5094 which can be considered fairly high. There are only five sectors which are found to have a significantly higher value of the coefficient of backward linkage as compared to the construction sector, viz., food products including beverages and tobacco, leather and leather products, electrical machinery, transport equipment, and miscellaneous

^{*5}As already noted in the third section above, the domestic transactions matrix is derived by subtracting the elements of import transactions matrix from the corresponding elements of total transactions matrix.

Table 2Measures Of Direct Inter-Industry Linkages Of Different Sectors In Indian Economy, 1973-74

Sector	Coefficient of Direct Backward Linkages (U_i)	Coefficient Of Direct Forward Linkages (W_i)
1	2	3
1. Agriculture And Allied Activities	0.2338	0.2744
2. Mining	0.1244	0.5967
3. Food Products, Beverages and Tobacco	0.7641	0.1007
4. Textile Products	0.5128	0.1750
5. Wood And Wood Products	0.3533	0.3656
6. Paper And Printing	0.5193	0.4079
7. Leather And Leather Products	0.8520	0.8214
8. Rubber, Plastic And Petroleum Products	0.5230	0.6342
9. Chemicals	0.4548	0.7159
10. Non-Metallic Minerals	0.3601	0.8352
11. Basic Metals And Metal Products	0.5895	0.6904
12. Non-Electrical Machinery	0.5134	0.1100
13. Electrical Machinery	0.5876	0.3313
14. Transport Equipment And Parts	0.5972	0.3559
15. Misc. Industries including Repair Services	0.7241	0.0562
16. Electricity	0.4861	0.0039
17. Construction	0.5094	0.1382
18. Railways	0.3077	0.3733
19. Other Transport	0.0809	0.3792
20. Other Services	0.0464	0.3370

industries including repair services. Of these five sectors, leather and leather products and miscellaneous industries are the sectors whose contribution to total gross output as well as final demand is less than one per cent. Thus, considering the relative importance of different sectors in the national economy, there are very few sectors which rank higher than construction in terms of the strength of direct backward linkages with other sectors. The relative position of construction sector, however, does not appear to be very high in terms of the strength of direct forward linkages. The rank of construction based on the coefficient of direct forward linkages is found to be 16 out of a total of 20 sectors.

The above findings indicate that construction has fairly strong backward linkages and mild forward linkages with other sectors. Strong backward linkage implies that growth of construction sector would provide significant stimulus for several other sectors to grow, whereas mild degree of direct forward linkage indicates that a substantial proportion of the construction sector's output is used for meeting the final demand rather than the inter-industry demand.

Measures of Direct and Indirect Linkages:

The measures of direct linkages suffer from the basic limitation of considering only the immediate impact or what may be called the first round effects. In view of the overall inter-dependence of different sectors, however, it is necessary to consider the total impact which would consist not only of the first round effects but also of the subsequent effects or the indirect effects. The strength of the backward linkages based on the direct as well as indirect effects of the expansion of a given sector is measured by coefficient of total linkage, whereas the strength of the forward linkage based on the direct and indirect effects of the expansion of different sectors on a given sector is measured by the coefficient of total linkage receipt. Table 3 shows these coefficients for different sectors.

It is interesting to observe from the estimates of total linkage coefficients for different sectors given in Table 3 that the pattern of ranking of different sectors found on the basis of direct backward linkage coefficient does not undergo any significant change when we measure the total effect including the direct as well as indirect

Table 3

Inter-Industry Linkages Including Direct And Indirect Effects,
1973-74

Sector	Direct And Indirect Increase In Aggregate Output Per Unit Increase In Final Demand	Coefficient of Total Linkage (Y_j)	Increase In Sectoral Output Induced By Unit Increase in Final Demand Of All Sectors	Coefficient of Linkage Receipt (Z_i)
1	2	3	4	5
1. Agriculture And Allied Activities	1.31	0.78	3.27	1.95
2. Mining	1.21	0.72	1.48	0.88
3. Food Products, Beverages And Tobacco	2.03	1.21	1.19	0.71
4. Textile Products	1.76	1.05	1.50	0.90
5. Wood And Wood Products	1.47	0.88	1.10	0.65
6. Paper And Printing	1.76	1.05	1.20	0.71
7. Leather And Leather Products	2.26	1.35	1.02	0.61
8. Rubber, Plastic And Petroleum Products	1.77	1.05	1.82	1.08
9. Chemicals	1.70	1.02	2.25	1.34
10. Non-Metallic Minerals	1.52	0.91	1.43	0.85
11. Basic Metals And Metal Products	1.79	1.07	2.58	1.54
12. Non-Electrical Machinery	1.80	1.08	1.13	0.67
13. Electrical Machinery	1.95	1.16	1.24	0.74
14. Transport Equipment And Parts	2.05	1.22	1.41	0.84
15. Misc. Industries Including Repair Services	2.15	1.28	1.04	0.62
16. Electricity	1.67	0.99	1.88	1.12
17. Construction	1.74	1.04	1.38	0.82
18. Railways	1.41	0.84	1.41	0.84
19. Other Transport	1.14	0.68	1.62	0.96
20. Other Services	1.07	0.64	3.62	2.16

effects. Thus, construction continues to occupy a relatively higher rank with not many sectors showing a significantly higher value of the coefficient of total linkage as compared to construction. In fact, considering the relative importance of different sectors measured in terms of their contribution to gross aggregate output and final demand, only three sectors, viz., food products including beverages and tobacco, electrical machinery and transport equipment have a significantly higher coefficient of total linkage as compared to the construction sector. It may be noted that based on the coefficient of direct backward linkage, the same three sectors are found to rank higher than construction.

In the case of forward linkages, the pattern of ranking shows some changes between the measure based on direct effects and the measure based on total effects including direct as well as indirect effects. Based on the coefficient of total linkage receipt, we find that there are nine sectors which rank higher than construction. These sectors are agriculture, mining, textile products, rubber and petroleum products, chemicals, basic metals and metal products, electricity, other transport, and other services.

As against this, the measure of direct forward linkages indicate that there are as many as 15 sectors having a significantly higher coefficient as compared to construction. Thus, the relative position of construction sector improves considerably when we include the indirect effects also while measuring the strength of the forward linkages. This implies that, although a large proportion of the construction sector's output is used for meeting the final demand, the total requirement of construction sector's output for supporting an overall expansion of the economy in terms of its inter-industry use is also significant. Thus, both backward as well as forward inter-industry linkages of construction sector are fairly strong and significant in relation to those associated with other sectors of Indian economy, especially when we consider the direct as well as indirect effects.

HOUSING EXPENDITURE AND SECTORAL GROWTH

The relationship between housing expenditure and sectoral growth has two aspects. The first aspect relates to the impact of an increase in housing expenditure on the output levels in different sectors. The second aspect relates to the effect of overall economic growth on the output level of the construction sector. In what follows, we have carried out this kind of impact analysis for every sector, to facilitate the inter-sectoral comparison.

Impact of Sectoral Expenditure on Output Growth:

The estimates of inter-industry linkages of construction sector with other sectors in the economy constitute the basis for analysing the relationship between changes in housing expenditure and the corresponding changes in the output levels of different sectors. For instance, the estimates of direct and indirect backward linkages of expenditure in the construction industry help us to quantify the effect of given increase in the housing expenditure in terms of the additional demand that it would generate for the output of different sectors. Table 4 shows the direct and indirect increase in the

Table 4

Total Increase In Sectoral Output Levels Induced By
Ten Percent Increase In The Final Expenditure In The
Construction Sector

Sector	Direct And Indirect Increase In Gross Output (Rupees Million at 1971-72 prices)	Additional Output as Percent of Total Output
1	2	3
1. Agriculture and Allied Activities	455.3	0.17
2. Mining	58.5	1.07
3. Food Products, Beverages And Tobacco	4.6	0.01
4. Textile Products	23.8	0.06
5. Wood And Wood Products	85.3	2.24
6. Paper And Printing	16.5	0.40
7. Leather And Leather Products	0.0	0.00
8. Rubber, Plastic And Petroleum Products	40.8	0.45
9. Chemicals	107.4	0.56
10. Non-Metallic Minerals	598.9	5.96
11. Basic Metals And Metal Products	578.1	2.17
12. Non-Electrical Machinery	2.0	0.02
13. Electrical Machinery	159.8	1.65
14. Transport Equipment And parts	11.1	0.10
15. Misc. Industries Including Repair Services	1.5	0.03
16. Electricity	90.6	0.88
17. Construction	4345.1	8.95
18. Railways	50.5	0.42
19. Other Transport	122.0	0.83
20. Other Services	684.8	0.55
Total	7436.6	1.11

gross output levels of various sectors that is induced by a ten per cent increase in the final expenditure in the construction sector valued at 1971-72 prices.*6

It is evident from the estimates presented in Table 4 that a ten per cent increase in the final expenditure in the construction sector induces an increase in the output of almost every sector in the economy. The sector in which the absolute increase in output levels that is induced by increased expenditure in construction can be considered as significantly high are agriculture and allied activities, chemicals, non-metallic minerals, basic metals and metal products, electrical machinery, other transport, and other services, besides the construction sector itself.

To examine the impact of increased expenditure on housing in relative terms, we can express the growth in sectoral output induced by increased expenditure as percentage of the existing output level. Based on this indicator, we find that a ten per cent increase in the final expenditure in construction sector leads to more than one per cent increase in the gross output levels of five sectors, viz., mining, wood and wood products, non-metallic minerals,

*6 According to the information available from National Accounts Statistics 1970-71 - 1975-76 (CSO, January 1978), gross capital formation in construction for the year 1973-74 is Rs.3,987 crores at current prices. The implicit price index of GCF in construction for 1973-74 with 1971-72 equal to 100 works out at 107.12. Hence GCF in construction for the year 1973-74 at 1971-72 prices is estimated at Rs. 4,271 crores. The ten per cent increase in the final expenditure in the construction sector would, therefore, be given by Rs. 427.1 crores.

basic metals and metal products, and electrical machinery. Similarly, it leads to more than one-half per cent increase in the gross output levels of another four sectors viz., chemicals, electricity, other transport, and other services. Thus, increased investment in housing would generate growth stimuli for several other sectors in the economy. According to our estimates, the total impact of a ten per cent increase in the final expenditure in the construction sector on the aggregate gross output level for the economy as a whole is an increase of the order of Rs. 747 crores (at 1971-72 prices) which is about 1.1 per cent of the existing output level in Indian economy for the year 1973-74.

Impact of Overall Growth on Sectoral Output:

The coefficient of total linkage receipt indicates the impact of one unit increase in the final demand of all sectors on the output of a given sector. However, the absolute increase of one unit in the final demand represents varying degrees of percentage changes because the absolute level of final demand in different sectors varies considerably. A more appropriate indicator of the strength of the forward linkages would, therefore, be the one that measures the impact of given percentage changes in the

final demand of each of the sectors on the output of different sectors. The impact of overall growth on the sectoral output depends not only upon the extent of growth but also upon the structure of growth. In this context, the most plausible assumption that can be made regarding the structure of growth is the one that reflects the of observed pattern of growth in the recent past. For the purpose of the present analysis, we have therefore considered the impact on the sectoral output of the same pattern of growth in the final demand of all sectors as observed during the period 1970-71 to 1975-76.*7 Table 5 shows the impact of the observed pattern of growth in the final demand of different sectors on the output levels in each of the twenty major sectors.

It is evident from the estimates presented in Table 5 that the average pattern of growth of final demand observed in recent years would induce varying degree of output growth in different sectors. In absolute terms there are five sectors, viz., agriculture, textile products, basic metals and metal products, construction and other services, whose output shows an increase of more than Rs. 100 crores at 1971-72 prices. Thus, in terms of

*7 The average annual rates of growth of final demand in different sectors that we have used in this analysis have been computed from the data available in the National Accounts Statistics, 1970-71 - 1975-76, CSO, Government of India; January 1978

Table 5

Total Increase In Sectoral Output Induced By The
Observed Pattern Of Growth Of Final Demand In All
Sectors

Sector	Observed Annual Growth Rate of Final Demand (In Percent)	Direct And Indirect Increase in Sectoral Output (Rs. Million at 1971-72 Prices)	Annual Growth Rate of Sectoral Output (In Percent)
1	2	3	4
1. Agriculture And Allied Activities	3.05	7640	2.91
2. Mining	5.36	224	4.09
3. Food Products, Beverages And Tobacco	0.85	383	0.92
4. Textile Products	4.64	1875	4.51
5. Wood and Wood Products	3.06	105	2.74
6. Paper And Printing	1.13	70	1.67
7. Leather And Leather Products	-	-	0.01
8. Rubber, Plastics & Petroleum Products	2.87	280	3.10
9. Chemicals	4.78	665	3.49
10. Non-Metallic Minerals	2.28	230	2.28
11. Basic Metals And Metal Products	5.01	1009	3.79
12. Non-Electrical Machinery	3.98	357	3.98
13. Electrical Machinery	3.98	347	3.58
14. Transport Equipment And Parts	3.98	420	3.86
15. Miscellaneous Industries Including Repair Services	-	7	0.14
16. Electricity	5.14	360	3.52
17. Construction	2.00	1023	2.11
18. Railways	4.07	443	3.68
19. Other Transport	6.24	720	4.87
20. Other Services	2.28	3015	2.42

the absolute increase in the sectoral output required to support and sustain the average pattern of growth of final demand in all sectors of the economy, construction ranks fourth among the twenty sectors.

To examine the impact of overall growth in the economy on the sectoral output levels in relative terms, it is necessary to compare the observed annual growth rate of final demand with the corresponding annual growth rate of sectoral output that is required to maintain the overall growth rate. From the figures given in Table 5, we can observe that there are six sectors whose output shows annual rate of growth which exceeds significantly the corresponding annual growth rate of final demand in each of these sectors. These sectors are food products including beverages and tobacco, paper and printing, rubber, plastics and petroleum products, miscellaneous industries, construction and other services. Of these six sectors, paper and printing and miscellaneous industries contribute less than one percent to the aggregate final demand as well as output of all sectors taken together. Thus, among the sectors which make a significant contribution

to the national economy in terms of their output levels and final demand, construction is one of the four sectors whose output is required to increase at a rate faster than the rate of growth of the sectoral final demand in order to maintain the overall pattern of growth. This implies that, given the pattern of national economic growth, the elasticity of construction sector's output with respect to its own rate of growth of final demand is greater than unity. Moreover, the construction sector ranks fairly high in relation to other sectors in terms of this kind of growth elasticity measure. Thus, it can be argued that the forward linkages of the construction sector are also fairly strong and significant in relation to other sectors, if we measure the strength of the forward linkages in terms of the effect of a given pattern of relative increase in the final demand instead of an absolute increase.

SUMMARY AND CONCLUSIONS

Finally, we may summarise the major findings of our study. The main conclusions that can be drawn from the above analysis are as follows:

1. For analysing the inter-industry linkages with a view to formulating overall resource allocation policy, the framework of aggregative sectoral classification based on the broad spheres of economic activity involving a more or less similar degree of aggregation is more appropriate than a framework based on a very high level of disaggregation in only a few sectors such as manufacturing.
2. In a twenty sector classification of the Indian economy, construction ranks third in terms of the sectoral contribution to the level of gross output as well as final demand in the economy as a whole, agriculture and other services being the only two sectors ranking higher than construction.

3. The construction sector has fairly strong direct backward linkages. Out of the twenty sectors of the economy, there are only three sectors having a share of more than one per cent in national gross output as well as final demand, which are found to have a significantly higher value of the coefficient of backward linkage as compared to the construction sector. These sectors are food products including beverages and tobacco, electrical machinery and transport equipment. The relative ranking of construction vis-a-vis other sectors remains more or less unchanged if we consider the direct as well as indirect effects while measuring the strength of backward linkages.
4. The rank of construction sector vis-a-vis other sectors based on the coefficient of forward linkage is sixteenth according to the measure based on direct effect and tenth according to the measure based on total effects including the indirect measures. This indicates that the total requirement of construction sector's output for supporting an

overall expansion of the economy is significantly high especially in terms of its inter-industry use.

5. There is a significant relationship between the housing expenditure and the sectoral growth. An increase in the final expenditure in the construction sector induces an increase in the output of almost every sector in the economy. An inter-industry analysis of housing expenditure suggests that the sectors which receive a higher degree of growth stimulus on account of increased investment in housing are mining, wood and wood products, non-metallic minerals, basic metals and metal products, electrical machinery, chemicals, electricity, other transport and other services.
6. The observed pattern of relative increase in the final demand of all sectors in the economy requires an increase of more than Rs. 100 crores (at 1971-72 prices) in the output levels of five sectors including construction, the other four sectors being agriculture, textile products, basic metals and metal products, and other services. Similarly, given the past pattern of

national economic growth, in terms of the elasticity of sectoral output growth with respect to the corresponding growth rate of sectoral final demand, construction sector ranks very high among the twenty major sectors of the economy, its elasticity being greater than unity.

The above analysis shows that housing expenditures have strong inter-industry linkages in Indian economy. Hence, an increase in housing investment would generate significant growth impulses in the economy which would be transmitted to several sectors. From a comparative viewpoint, the direct as well as indirect impact of additional housing expenditure is found to be more powerful than that of additional final expenditure in many sectors of the economy. This clearly suggests that housing should receive a high priority in the allocation of scarce national resources because, through its backward and forward linkages with the rest of the economy, it would be instrumental in stimulating and accelerating the pace of economic growth. Thus, we can conclude that in formulating a national resource allocation policy based on the objective of maximising the growth impulses of investment expenditure and thereby inducing a higher rate of growth, a high priority should be accorded to investment in housing.

APPENDIX TABLE 1

Total Input-Output Coefficient For The Year 1973-74

Sector	(Per Rupee Of Output at Factor Cost at 1971-72 Prices)						
	1	2	3	4	5	6	7
	Agriculture And Allied Activities	Mining	Food Products, Beverages And Tobacco	Textile Products	Wood And Products	Paper And Products	Printing
1. Agriculture And Allied Activities	.1550326	.0077644	.4037232	.2156728	.1435949	.1035067	
2. Mining	.0000036	.0039989	.0037374	.0011987	.0000574	.0075021	
3. Food Products, Beverages And Tobacco	.0022129	0.0000000	.0740942	.0010499	0.0000000	.0026647	
4. Textile Products	.0000170	0.0000000	.0049108	.1331663	.0013037	.0105995	
5. Wood And Wood Products	0.0000000	0.0000000	.0036431	.0005616	.0347717	.0004023	
6. Paper And Printing	0.0000000	.0017998	.0034161	.0057259	.0037295	.2295239	
7. Leather And Leather Products	0.0000000	.0000830	0.0030000	.0000691	0.0000000	0.0000000	
8. Rubber, Plastic And Petroleum Products	.0009057	.0238927	.0025376	.0027329	.0081715	.0049247	
9. Chemicals	.0241424	.0159835	.0058761	.0462070	.0351253	.1390195	
10. Non-Metallic Minerals	0.0000000	.0075463	.0089197	.0000109	0.0000000	.0013755	40
11. Basic Metal And Metal Products	.0002610	.0078919	.0149463	.0300741	.0007610	.0005807	
12. Non-Electrical Machinery	0.0000000	.0122492	0.0000000	.0014378	0.0000000	.0000028	
13. Electrical Machinery	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	
14. Transport Equipment And Parts	0.0000000	.0002886	0.0000000	0.0000000	0.0000000	0.0000000	
15. Misc. Industries Including Repair Services	.0000191	.0072593	.0005638	.0002355	.0003953	.0001297	
16. Electricity	.0059376	.0248679	.0065604	.0147031	.0063843	.0361616	
17. Construction	.0107764	.0046225	.0113737	.0081246	.0121099	.0157063	
18. Railways	.0044723	.0032305	.0063272	.0047121	.0055991	.0233081	
19. Other Transport	.0013544	.0017031	.0115547	.0127901	.0264879	.0350367	
20. Other Services	.0355829	.0012411	.2020455	.0750349	.0763064	.0958171	
Total	.2407179	.1244227	.7692298	.5535073	.3547979	.7062619	

Appendix Table 1 (continued)

Sector	8	9	10	11	12	13	14
	Leather And Leather Products	Rubber, Plastic And Petroleum Products	Chemicals	Non-Metallic Minerals	Basic Metal And Metal Products	Non-Electrical Machinery	Electrical Machinery
1	.4241872	.0242583	.0150591	.0052622	.0007913	.0061821	.0009064
2	.0002386	.2906586	.0247576	.0533640	.0298752	.0003560	.0019036
3	.0273005	.0094866	.0288470	.0000020	0.0000000	.0002190	0.0000000
4	.0014424	.0739014	.0084324	.0252231	.0003428	.0074807	.0043539
5	.0018625	.0004353	.0020132	.0020880	.0004997	.0027950	.0046843
6	.0105440	.0025105	.0059510	.0035438	.0036656	.0058526	.0069606
7	.0187430	.0000957	.0000055	0.0000000	0.0000000	0.0000000	0.0000000
8	.0959346	.0760383	.0282974	.0178363	.0123104	.0158901	.0388982
9	.1043451	.0961868	.2443652	.0205972	.0119008	.0091673	.0157074
10	.0183084	.0005437	.0359579	.0638123	.0120332	.0015745	.0383676
11	0.0000000	.0066561	.0144896	.0312848	.2926427	.2221260	.2577872
12	0.0000000	.0000917	.0000002	.0000093	.0015227	.0960828	.0025116
13	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	.0193335	.1111624
14	0.0000000	0.0000000	.0000061	0.0000000	.0001481	.0013281	.0000004
15	.0007483	.0001829	.0027537	.0003260	.0002386	.0000261	.0012529
16	.0199979	.0118687	.0313181	.0338553	.0240480	.0136518	.0065226
17	.0424112	.0063098	.0098649	.0128946	.0126406	.0182100	.0108887
18	.0164682	.0180909	.0180449	.0360403	.0295695	.0229028	.0122064
19	.0552149	.0150277	.0230478	.0231373	.0116297	.0245266	.0218816
20	.0185293	.1003241	.0697019	.0534504	.1114438	.1187981	.1189051
	.8562761	.7326671	.5629135	.3827269	.5553027	.5865031	.6549009

Appendix Table 1 (concluded)

Sector	Transport	Miscellaneous	Electricity	Construction	Railways	Other	Other
	Equipment And Parts	Industries Including Repair Services	17	18	19	Transport	Services
	15	16	17	18	19	20	21
1	.0050716	.0772110	.0000087	.0620786	.0000208	0.0000000	.0019665
2	.0003279	.0026030	.0283740	0.0000000	.0155563	.0000602	.0002863
3	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	.0007851
4	.0000001	.0734517	0.0000000	0.0000000	.0029347	.0007435	.0001309
5	.0002661	.0063072	0.0000000	.0143349	.0001201	.0002274	.0000579
6	.0024619	.0357290	.0023201	.0017662	.0041369	.0037354	.0008578
7	0.0000000	.0000927	0.0000000	0.0000000	.0000063	.0000240	.0000006
8	.1316053	.0891056	.0062954	.0000239	.0039625	.0629488	.0024327
9	.0082755	.1452598	.0002223	.0112327	.0013799	0.0000000	.0013141
10	0.0000000	.0051132	0.0000000	.1247235	.0031161	0.0000000	.0000354
11	.1206964	.0793918	0.0000000	.0918507	.0079685	.0008613	.0000523
12	.0019937	0.0000000	0.0000000	0.0000000	.0004270	0.0000000	.0000820
13	.0106593	.0139257	.0075107	.0326163	.0025081	.0010679	.0017812
14	.2180994	.0003114	0.0000000	0.0000000	.0298248	.0228493	.0062916
15	.0025664	.0148250	.0003733	0.0000000	.0002358	0.0000000	.0001836
16	.0097366	.0483737	.1843698	.0054560	.0448483	.0000150	.0043770
17	.0079787	.0244024	.0138822	.0096856	.0061561	.0033162	.0074810
18	.0096849	.0109529	.0229504	0.0000000	.0008288	0.0000000	.0024573
19	.0059792	.1184658	.0198156	.0198159	.0301424	.0077544	.0003502
20	.0917850	.0078347	.2000581	.1132913	.1535711	.0048865	.0156337
		.6262880	.7533566	.4861806	.8168753	.3084859	.046557

Source: A Technical Note On The Approach To The Fifth Plan Of India, 1974-79, Planning Commission, Government Of India; April 1973.

APPENDIX TABLE 2

Import Coefficients for The Year 1973-74

Sector	(Per Rupee Of Output At Factor Cost at 1971-72 prices)						
	1	2	3	4	5	6	7
	Agriculture And Allied Activities	Mining	Food Products, Beverages And Tobacco	Textile Products	Wood Products	Paper And Printing	
1. Agriculture And Allied Activities	.0000052	0.0000000	.0005845	.0342743	.0010485	0.0000000	0.0000000
2. Mining	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	.0000621	0.0000000
3. Food Products, Beverages And Tobacco	.0000144	0.0000000	.0041676	0.0000000	0.0000000	0.0000000	0.0000000
4. Textile Products	0.0000000	0.0000000	.0003623	.0028935	0.0000000	0.0000000	0.0000000
5. Wood And Wood Products	0.0000000	0.0000000	0.0000000	0.0000000	.0002641	0.0000000	0.0000000
6. Paper And Printing	0.0000000	0.0000000	.0000142	.0000048	0.0000000	.1869015	0.0000000
7. Leather And Leather Products	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
8. Rubber, Plastic And Petroleum Products	0.0000000	0.0000000	0.0000000	.0000691	.0002040	0.0000000	0.0000000
9. Chemicals	.0069043	0.0000000	1.0000000	.0033884	.0000015	0.0000000	0.0000000
10. Non-Metallic Minerals	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
11. Basic Metal And Metal Products	0.0000000	0.0000000	.0000104	0.0000000	0.0000000	0.0000000	0.0000000
12. Non-Electrical Machinery	0.0000000	.0000224	0.0000000	.0000331	0.0000000	.0000007	0.0000000
13. Electrical Machinery	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
14. Transport Equipment And Parts	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
15. Misc. Industries Including Repair Services	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
16. Electricity	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
17. Construction	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
18. Railways	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
19. Other Transport	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
20. Other Services	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

1. Total .0069239 .0000224 .0051190 .0406632 .0015181 .1869650

Appendix Table 2 (continued)

Sector	Leather And Leather Products	Rubber, Plastic And Petroleum Products	Chemicals	Non-Metallic Minerals	Basic Metal And Metal Products	Non-Electrical Machinery	Electrical Machinery
1	8	9	10	11	12	13	14
1	.0041862	.0055266	.0007868	0.0000000	0.0000000	0.0000000	0.0000000
2	0.0000000	.1858728	.0074444	.0014396	.0004468	0.0000000	0.0000000
3	0.0000000	0.0000000	.0076484	0.0000000	0.0000000	0.0000000	0.0000000
4	0.0000000	.0005580	0.0000000	0.0000000	0.0000000	0.0000000	.0000118
5	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
6	0.0000000	0.0000000	.0000050	0.0000000	.0000839	.0001032	.0000149
7	.0000932	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
8	0.0000000	.0038229	.0009096	.0000009	.0001262	.0002480	.0011196
9	0.0000000	.0138535	.0852852	.0000002	.0000008	.0000011	.0000017
10	0.0000000	0.0000000	.0059169	.0208852	.0019752	0.0000000	.0001289
11	0.0000000	0.0000000	.0000793	.0002508	.0428244	.0641666	.0528313
12	0.0000000	.0000525	0.0000000	.0000047	.0003050	.0085464	.0005707
13	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	.0126528
14	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
15	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
16	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
17	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
18	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
19	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Total	.0042794	.2096863	.1080666	.0225814	.0457623	.0730653	.0673317

Appendix Table 2 (concluded)

Sector	Transport Equipment And Parts	Miscellaneous Industries Including Repair Services	Electricity	Construction	Railways	Other Transport	Other Services
	15	16	17	18	19	20	21
1	0.0000000	.0002476	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
2	0.0000000	.0008376	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
3	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
4	0.0000000	.0001511	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
5	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
6	.0000069	.0001809	.0001143	0.0000000	.0000014	0.0000000	.0001410
7	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
8	.0007545	.0125305	0.0000000	0.0000000	0.0000000	.0275405	0.0000000
9	.0000019	.0000070	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
10	0.0000000	.0020542	0.0000000	.0004517	0.0000000	0.0000000	0.0000000
11	.0280927	.0051627	0.0000000	.0050670	0.0000000	0.0000000	0.0000000
12	.0002645	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
13	0.0000000	.0065778	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
14	.0000336	0.0000000	0.0000000	0.0000000	0.0000000	.0000200	0.0000000
15	0.0000000	.0023044	0.0000000	0.0000000	0.0000000	0.0000000	.0000319
16	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
17	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
18	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
19	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
	.0291241	.0292737	.0001143	.0055107	.0000014	.0275605	.0001729

Source: A Technical Note On The Approach To The Fifth Plan Of India, 1974-79, Planning Commission, Government of India; April 1973.

APPENDIX TABLE 3

Elements of the Inverse Matrix* Indicating The Direct and Indirect Output Effects Of Changes In Final Demand

Sector	1	2	3	4	5	6	7
	Agriculture And Allied Activities	Food Products, Beverages And Tobacco	Mining	Textile Products	Wood Products	Wood Products	Paper And Printing
1. Agriculture And Allied Activities	1.187370						
2. Mining	.001377		1.009640				
3. Food Products, Beverages And Tobacco	.003452	1.077300	.000933				
4. Textile Products	.000634	.007199	.003791	1.151560			
5. Wood And Wood Products	.000349	.004616	.000330	.001190	1.036210		
6. Paper and Printing	.000364	.010297	.002791	.007936	.004787	1.046610	
7. Leather And Leather Products	.000001	.000002	.000090	.000083	.000003	.000006	
8. Rubber, Plastic And Petroleum Products	.002551	.007062	.028768	.008249	.012762	.015134	
9. Chemicals	.025186	.024216	.025076	.067583	.049979	.179891	
10. Non-Metallic Minerals	.002788	.014139	.009985	.004925	.003981	.010720	
11. Basic Metal And Metal Products	.003142	.026673	.016809	.050927	.005222	.010013	
12. Non-Electrical Machinery	.000034	.000140	.013566	.001946	.000073	.000286	
13. Electrical Machinery	.000727	.001537	.000966	.001159	.001002	.001808	
14. Transport Equipment And Parts	.000752	.003033	.000980	.001966	.002039	.003695	
15. Misc. Industries Including Repair Services	.000124	.000801	.007529	.000572	.000618	.000838	
16. Electricity	.010702	.017944	.034585	.029057	.013435	.058918	
17. Construction	.013931	.021569	.006885	.015388	.016614	.022964	
18. Railways	.006439	.012448	.006508	.010904	.008790	.031227	
19. Other Transport	.003161	.016568	.005066	.019381	.030668	.045095	
20. Other Services	.051254	.256830	.020468	.120263	.100074	.146280	

* $(I-T+M)^{-1}$ where I denotes the Identity Matrix; T denotes the Total Input-Output Coefficients Matrix and M denotes the Import Coefficients Matrix

Appendix Table 3 (continued)

Sector Number	Leather And Leather Products	Rubber, Plastic And Petroleum Products	Chemicals	Non-Metallic Minerals	Basic Metal And Metal Products	Non-Electrical Machinery	Electrical Machinery
	8	9	10	11	12	13	14
1	.540579	.056685	.042666	.019209	.007418	.017659	.012333
2	.019150	.118872	.030264	.061813	.045434	.013007	.021810
3	.036044	.014138	.028011	.001219	.000981	.001285	.001626
4	.014617	.093466	.016969	.033347	.003552	.012771	.012640
5	.003668	.001147	.003109	.002774	.001237	.004058	.006215
6	.013867	.005077	.008892	.005273	.006024	.008637	.010538
7	1.019020	.000124	.000016	.000011	.000007	.000006	.000010
8	.116081	1.087370	.040522	.026142	.022387	.027080	.054961
9	.155046	.116905	1.199880	.033941	.024721	.022477	.036159
10	.032693	.007402	.040888	1.049530	.018229	.009955	.051880
11	.015271	.020466	.030171	.049968	1.339520	.243879	.311632
12	.000336	.001841	.000504	.000987	.002446	1.096550	.003127
13	.002762	.001174	.001479	.001479	.001738	.025335	1.110870
14	.003828	.002874	.003031	.003274	.003946	.005788	.003719
15	.001470	.001490	.003676	.000978	.000807	.000358	.001838
16	.042721	.029711	.053968	.052689	.046929	.031827	.026865
17	.055141	.012517	.016477	.017596	.020621	.026890	.020464
18	.027762	.025111	.027182	.042531	.043141	.035581	.028018
19	.068071	.023388	.033622	.030002	.020371	.034723	.033992
20	.95647	.146786	.122282	.092135	.177777	.186776	.196818

Appendix Table 3 (concluded)

Sector Number	Transport Equipment And Parts	Miscellaneous Industries Including Repair Services	Electricity	Construction	Railways	Other Transport	Other Services
1	.021367	.132473	.004541	.106603	.004316	.003690	.004163
2	.027499	.024229	.037512	.013700	.019864	.005116	.001193
3	.003013	.006280	.000475	.001076	.000457	.000618	.000980
4	.017054	.097204	.001568	.005563	.004950	.004692	.000640
5	.001093	.008049	.000508	.019963	.000414	.000385	.000249
6	.005526	.041436	.003626	.003855	.005158	.004290	.000919
7	.000023	.000119	.000006	.000004	.000011	.000030	.000001
8	.187492	.100272	.012640	.009544	.013524	.043319	.004269
9	.037874	.203298	.004413	.025150	.005979	.005945	.002682
10	.006373	.016464	.003828	.140234	.005325	.001004	.001374
11	.169461	.118456	.007447	.135358	.019219	.006673	.003008
12	.001856	.000685	.000582	.000476	.000833	.000119	.000127
13	.016523	.010711	.011697	.037413	.004536	.001765	.002477
14	1.281800	.006102	.004069	.002607	.040748	.029667	.008370
15	.003789	1.013600	.000833	.000354	.000575	.000149	.000204
16	.029078	.081252	1.231550	.021222	.059008	.002169	.006278
17	.017047	.035178	.020295	1.017360	.009683	.004423	.008123
18	.023559	.025180	.030046	.011826	1.004450	.001690	.003091
19	.016697	.135674	.027111	.028560	.033379	1.009380	.001135
20	.178068	.092273	.262794	.160342	.179838	.015983	1.021230

Source: Appendix Tables 1 and 2