CHAPTER IV

INPUT AND CAPITAL STRUCTURES AS PARAMETERS OF INSTANTANEOUS PRODUCTION FUNCTIONS OF FIRMS AND TECHNOLOGICAL PROCESSES IN STEEL FORGINGS INDUSTRY
1.0 Introduction

In the light of investigation of firms and their technological processes, products and materials of steel forgings industry in India, as depicted in the earlier chapter III, here, the inputs and capital structures of the firms and intermediate processes, as the technological parameters of the economic production functions of the production units, have been examined in the context of Leontief Input output analysis. The theoretical frame and the empirical analysis of this instantaneous production function approach have been dealt with broadly under the following:

1. A discussion on the development of different analytical approaches or methods to explain the production theories of firms or of an industry,

2. A discussion on the nature, uses and limitations of Leontief input output analysis as a production function approach to a firm or an industry,

3. A discussion on the conceptual and empirical problems along with their associated adjustments carried out for refinement in the evaluation of inputs and capital structures of firms and intermediate processes in steel forgings industry in particular and in the preparation of input output tables of an economy in general.

4. Analysis of the inputs and capital structures of the firms and intermediate processes in this industry.
Production theories - discussion on Development of the analytical approaches

About two centuries ago, Francois Quesney\(^2\) propounder of physiocratic school, published his "Tableau Economique" (1758), in which the idea of the compartmentalized treatment of necessarily interdependent production activities was first formally advanced. But the idea remained dormant until the time of Leon Walras\(^3\) (1874) who employed a similar approach to state the interdependence among the production sectors of the economy in terms of the competing demands of each industry for factors of production and of the substitutability among their outputs in consumption. The main use of his mathematical formulations is to demonstrate the existence of determinate solutions for the quantities and prices in the system under the assumptions of maximizing behaviour. But these formulations too remained as a theoretical analysis until 1930's, when W.W. Leontief\(^4\) gave a

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1 Here, a brief presentation of the development of the analytical approaches to production theories is attempted. For a critical review, see Mathur, P.N., "Input output Frame work for explorations in theoretical and empirical economic research", Artha Vijnana, June 1969, Vol. XI, No. 2, pp.133-148.


practical tool of analysis to derive a set of parameters for his model from a single point observation of each of the inter-industry transactions in the economy. This inter-dependent multisectoral instantaneous production function approach provides at any point of time only the equilibrium production points with a set of fixed coefficients observed in the economy. Later on, Dantzig and Koopmans\(^5\) (1951) developed the mathematical technique of activity analysis or linear programming in the field of inter-industry economics to study the production theories of a production unit as well as of the economy as an interdependent sectoral system. These analytical approaches are of modern production theories.

On the other hand, traditional Marshallian partial equilibrium analysis specifies the relationships between the economic variables of a sector, through sets of supply and demand functions, assuming no significant change in the economic variables of other sectors. The main distinction between traditional production theory of partial equilibrium or of general equilibrium analysis and modern production theory of Leontief general equilibrium analysis or inter-dependent multisectoral instantaneous approach, may be described as follows:

A production process is described as a transformation

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of one set of variables - the inputs or the factors of production, into another, the outputs. The quantitative relationships between inputs and outputs are determined by the set of all available technological alternatives. In the traditional production theory, among all the available input output combinations technically possible, the firm chooses one which maximises the difference between total revenue and total costs under ceteris paribus conditions. All available transformation possibilities are stated in the form of one or more well behaving 'production functions' with continuous partial derivatives through the entire relevant range, attaining a local maximum. Since a fully detailed description of the actual shapes of all the transformation (production) functions of all firms in the economy is a nonfeasible proposition, the theory of production of the firms and of individual industries had to be reformulated in terms of discrete instantaneous production functions observed at and applicable to different points of time. The latter approach gives only one way of producing the given amount as the best process with invariant proportions of factors of production in the short run. The Leontief system can be considered as a multi-industry counterpart of Marshall's short run partial analysis and may be labelled as short run general analysis. Thus,


7 Mathur, P.N., op. cit., Artha Vijnana, pp. 138-139.
the inter industry disaggregative analysis serves better than the partial equilibrium analysis to a detailed study of the production theory of firms, processes and of an industry in the context of interindustry system of an economy.

4.1.1 The Walrasian general equilibrium approach in comparison with the Leontief's instantaneous approach as an empirical tool of the former to the production theory of firms, processes and of industry

There is no counterpart in the Leontief system to Walrasian market supply functions for factors and demand functions for goods. In the simplest static open Leontief model total outputs demanded are found in terms of the levels of final demand. Walras' utility functions for the individual also have no counterpart in the Leontief's open system as the consumption levels are specified outside the open model. In the closed Leontief model, they conform to the strict fixed coefficient requirement.

Input output analysis is like general equilibrium analysis in that it encompasses all products and industries at the disaggregative level of classification of the sectors and serves as an empirical tool to the latter. However, input output analysis is unlike general equilibrium theory in that

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it is not in itself an equilibrium system. Leontief's attempt was indeed to render the Walrasian system, which had a remote majesty but was empirically unworkable, to manageable proportions by constructing a model of interdependence - as against the Walrasian interfirm and interpersonal dependence - which required relatively fewer parameters to be determined from a single point observation.

From these viewpoints, it is preferred in the following analysis to find the fixed coefficients as equilibrium production points. Those fixed coefficients serve as parameters of interdependent, multisectoral instantaneous production functions of firms or of industry.

4.2 Input output analysis - its nature and uses to a firm or industry

The system of balance equations and the economic logic behind them are often found in Economic literature, to derive the production levels, price proportions vectors, employment levels, wages, interest and profit relationships; the effects of foreign trade vectors etc. and the conditions


for internal consistency and viability of both closed and open input output models. In these balance equations, instead of the traditional production function of an industry

$$x_i = f(x_{i1}, x_{i2}, \ldots, x_{in})$$

of the type $x_i = f(x_{i1}, x_{i2}, \ldots, x_{in})$, the technical set up of each industry, is described by a series of as many homogeneous linear equations as there separate cost factors.  

$$x_{il} = a_{il} x_i, \ldots, x_{in} = a_{in} x_i \quad (i=1, 2, \ldots, r)$$

The complete set of coefficients $a_{ij}$ arranged in the form of a matrix $[a_{ij}] = A$, corresponding to the input output flow table $[x_{ij}] = X$, is called the 'structural or technical coefficients' matrix, whereas $[I-A]$ matrix is the technology matrix. Each column vector of $[I-A]$ provides the process of a unique input output combination to produce the unit output level of the corresponding activity or a sector. The inputs are represented by negative sign, whereas the output is shown by positive sign for the sector concerned in $[I-A]$ matrix. In the flow input output table $[x_{ij}]$, the figures entered in the column of the table describe the inputs consumed by the corresponding sector, whereas the row elements give the distribution of the output of the row sector as inputs of column sectors. Similarly, the column vector of $A$ matrix provides the input structures of the corresponding sector and the elements of row vector of $A$ matrix provide the distribution of the output of the corresponding row sector per unit outputs of the different using column sectors. It

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is these column input structures, serving as technological parameters of instantaneous production functions, of the activities or sectors and their stability that we attempt to evaluate in this study. Once the consistency and stability of the column input structures are established, the row vector elements will be evidently given as they are.

Although, in principle, the intersectoral flows can be thought of as being measured in physical units, in practice most of the input output tables are constructed in value terms at constant prices or at basic prices, as the aggregation of the different units of measurements of the sectors becomes difficult. The input output table is said to be at basic prices as good as at physical units, if the physical units are expressed in terms of one rupee worth of the amount, as a single unit of production of all the sectors, at the prices prevailing at the time of the table construction.

4.2.1 Uses of A matrix to a firm or an industry

If one needs to know how much of labour or how much of imports or any other sector's output is required directly in producing a unit output of a particular sector, one can find answer by constructing production accounts and there is no need for input output analysis. But if one unit of the output of an industry is to be delivered to final demand, it is necessary to produce - (1) the original unit of output, (2) all direct inputs to make this possible, (3) all the indirect inputs required for the chain relationship of the inputs and outputs of interdependent industries to fulfill
the direct inputs of the industry concerned. All these are being taken into account by the convergent series of \((I-A)^{-1}\) matrix which is equivalent to \(I + A + A^2 + \ldots\), usually known as matrix multiplier. Information of this kind is clearly useful for the purpose of industrial decisions, which cannot be reached by direct observation or by production accounts alone. The product of the matrix multiplier and a vector of final demand of different compositions, will provide different sets of output levels estimates, which are also a useful information to a firm in the market research departments. A businessman can compare his company's marketing position with that of an industry, of which it is a part, and note possible areas of additional market potential. To the extent that an individual firm deviates from its industry's average, "the industry of which the firm is a part" approach is less than satisfactory.  

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4.2.2 Dynamic analysis to a firm or an industry

Every industry requires, apart from the flow requirements of production in the sector, some stocks to carry on productive activity. If an industry increases its output, its demand for the products of other sectors of the economy goes up, not only on account of increased current input requirements, it will also absorb additional inputs to enable to increase its necessary stock holdings. In the case of diminished output, it is necessary to distinguish between inventory holdings and investments of the more fixed kind. The first can be used up through transformation into inputs on a current account, while the fixed stocks cannot be adjusted downward through the same simple process of absorption on current account. Under the first category, stocks of raw materials, goods in process, semifinished and finished products will fall, while, under the later category, buildings, plant and machinery transport equipment and other fixed assets will be included. When the stock requirements of an industry go down in proportion to diminished output, the fixed equipment are not diminished accordingly. Instead the difference between the technically necessary and actually available stocks results in the appearance of unused or idle capacity. In the case of a subsequent upturn, the current input requirements of the industry will naturally at once begin to grow in proportion to its increased output. Besides, the inputs are required to be replenished in accordance with their stock requirements, which are based

on both fixed capital coefficients and working capital coefficients. These capital structures involving time dimension, are the parameters of the expanded differential balance equations of dynamic input output analysis. 16

4.2.3 Dynamic analysis for an economy

Due to basic linearity, Dynamic input output model has been conceived as a summation of one or more Leontief Trajectories. Each Leontief trajectory may be considered as an independent economy growing at its own pace and is not conditioned by the growth or otherwise of any other part of the economy. Apart from meeting input and capital requirements, each Leontief trajectory throws out a vector of final demand to be consumed exogenously. A Leontief Trajectory growing at the technically feasible highest rate of growth is known to have balanced growth without throwing out any final demand to have a unique structure of production, which is often termed as turnpike. 17 If the structure of production does not correspond to the structure of this highest growth factor, investment should first be so directed to achieve this.


The dynamic analysis can also take into account the year to year changing technology and consumption pattern.\(^{18}\) While it is not attempted to review all aspects and applications of dynamic input output models, attempted by various authors,\(^{19}\) for different purposes, the main tool of the dynamic analysis are presented in this industry study.

18 Ibid.

19 Apart from those already referred to in this chapter, the following applications are of significant importance:

(a) Mathur, P.N., "An application of dynamic input output model for planning".
(b) Mathur, P.N., "Use of shadow prices in a developing economy".
(c) Bhatia, V.G., "Measurement of Economic development and growth potential".
(d) Panchmukhi, V.N., "Planning for import substitution: Some methodological and empirical results."

(a) to (d) all in Economic Analysis in Input Output Framework, ed. by Mathur, P.N., and Bharadwaj, K., Poona, 1967.


(h) Mathur, P.N., "Expected Production and its Pattern, 1985-86".

(i) Mathur, P.N., "Explorations in making programme of full capacity utilization". (h) and (i) in Artha Vijnana, June 1969, Vol. XI, No. 2, pp. 306-331.


4.2.4 Nature of capital matrices - Average and incremental capital structure

Basic to these dynamic models is the fixed capital coefficients per unit capacities of the sectors and the working capital coefficients per unit outputs of the sectors as the Capital structural matrices. Considering the latter separately as they involve less time dimension, similar to current input structures, the average fixed capital coefficients are given by

\[ b_{ij} = \frac{S_{ij}}{\lambda_j} \] where \( S_{ij} \) are the stocks of \( i \)-th good held by \( j \)-th industry, and \( \lambda_j \) is the capacity of sector \( j \), both at a point of time \( t \). In the dynamic models, in principle, it is the incremental capital coefficients, given by

\[ b_{ij} = \frac{\Delta S_{ij}}{\Delta \lambda_j} \]

that are of significant role. These are to be obtained from the project reports or from engineering data or from new plants' financial data. If two points data are available, then also they may approximate to

\[ b_{ij} = \frac{S_{ij}(t+1) - S_{ij}(t)}{\lambda_j(t+1) - \lambda_j(t)} \].

But such an estimation has serious limitations if there is capital imbalance within the industry. In the absence of getting incremental coefficients by any of the above methods, one may consider that they may approximate to average capital coefficients. To allow for changes in flow and capital coefficients with the industrial growth, it is necessary to distinguish between average technical coefficients of an industry, of a firm or of a process reflecting an existing capacity and incremental coefficients or marginal coefficients, characterizing those portions of capacity which are being added in the
4.3 Assumptions and Limitations of input-output analysis

The predictive value of the input-output analysis for any problem depends on the stability of the technical coefficients during the period between that of table construction and of application of the model. Computation of the stable technical coefficients of an industry, which are crucial to depict the structure of the economy in terms of the interdependence of the sectors, is of utmost importance for all practical uses and theoretical conveniences.

There are at least six situations21 of theoretical

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21 Apart from others, summary of the following is attempted:

(g) Koopmans, T.C., "Alternative proof of substitution theorem for Leontief models in the case of three industries".

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interest and of practical importance under which the technical coefficients become unstable as given below:

First, is when a plant or an industry is subject to economies of scale. Leontief’s assumption of constant returns to scale is contrasted on the ground that functions more complex than simple proportions of instantaneous production functions, are necessary to describe the production processes, particularly in capital based industries having longer gestation periods.

Second, is when substitution between inputs takes place. This is because substitution between inputs may take place in the long run, when relative prices change. P.A. Samuelson proved a proposition about substitution, namely: the absence of substitution among inputs in the open input output analysis does not need to be assumed, for it is already implied in the assumptions of efficiency in production, constant returns to scale, absence of joint products and the existence of just one scarce primary resource (i.e. a scarce resource that is not produced). The theorem says, in effect, that even though the production functions allow substitution among inputs, it does not take place, no matter how the final bill of goods is changed, because the achievement of efficiency in production always leads to a unique set of input output ratios for each

(h) Arrow, K.L., "Alternative proof of substitution theorem for Leontief models in the general case". All (f), (g) and (h) are in Activity Analysis for Production and Allocation, 1962, ed. by Koopmans, T.C.

industry. Some economists admitted the possibility of alternative techniques of production to produce a product by several different processes or input output combinations. If this modification alone is made, the assumption of constant returns to scale being retained, then the open form of input output analysis turns into linear programming analysis. This is strictly true only if the number of alternative processes for producing a product is finite. If the number of alternative processes is infinite, they form a smoothly curved production surface, then the open form of input output analysis becomes the traditional continuous production functions theory.

Thirdly, there are practical problems of product mix arising as a result of horizontal integration of identical technological processes or firms producing multiple products for the sector specification in input output tables. While the composition of the final demands of the products are fluctuating. Here, the assumption is that the product mix of all aggregated firms remains the same over a period. If the composition of products in the firms is fluctuating very much and each of those products has separate final demand and independent input structures, it is essential to distinguish those products as independent sectors in the input output analysis. Leontief's assumption of no joint products is thus contrasted for practical problems.

Fourthly, there are practical problems of process mix, arising due to vertical integration of separate technological processes in a firm or an industry while the techniques of
individual processes are changing. If the processes are separately identified as sectors, then the input structures of processes or sectors can be corrected in the light of changes in technique and the individual processes. The assumption that the economy will operate always at the currently available best practice technology, is not a feasible proposition, because a developing economy operates with an admixture of old and new techniques all through the period of its technological transformation.

Fifthly, while the day-to-day operation of a modern economy is determined primarily by the static input output analysis models, the exploration and explanation of its longer run developments must be approached through the stock flow relationships of structural time lags and of technological changes in the equipment itself. Because of these dynamic elements also, structural coefficients are likely to vary. Those dynamic elements are properly to be identified and taken care of, through suitable dynamic input output models approximating to reality rather than on hypothetical considerations.

Sixthly, the practical problems in respect of different capital intensities, managerial organizations, working conditions, of production units. Market imperfections also cause the instability of input structures of an industry.

Seventhly, the problems of product multidimensionality, and of continuous changes in product dimensions as discussed in Chapters VI and VII, also cause variations in the input structures of firms and of the industry, especially in the case of
Jobbing type industries. Assumptions of no joint products and a single process to produce a single product, may at best take care of the problems of product mix and process mix by a suitable choice of classification and aggregation. But they can not take care of the problems of product multidimensionality and of continuous product dimensions for which reliance on the empirical studies of production functions of individual industries from the engineering data is the only alternative.

4.4 Conceptual and practical problems in the empirical evaluation of capital and input structures of firms, processes and industry

While there are various studies to analyse and to test the assumptions underlying the instantaneous production functions of Leontief input output analysis, they are not attempted for review in this industry study. But it is attempted to discuss the practical and conceptual problems in the empirical computation of the structural coefficients in the preparation of usual input output tables in general and in this industry study in particular. In the context of developing economies, they are of particular interest. All such problems are common to the firms and processes of an industry, taking into account individual technologies and industrial practices, to improve the stability of technical parameters of a sector. The need for disaggregative input output tables stems from the fact that each process or the stage of operation may have its own unique

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(b) Hatanaka, M., Workability of Input Output Analysis, Germany, 1960.
input output combination producing an unit level of that
operation or activity.  

4.4.1 Incremental and average coefficients

Four general types of estimates of incremental coefficients are as follows:

(i) "New plant coefficients": Estimates derived by observing the performance records of new plants.

(ii) "Cross section estimates": Estimates inferred statistically from observed changes in the coefficients of older establishments' capacity expansion.

(iii) "Industry time series coefficients": Estimates inferred statistically from observed changes in the coefficients of the industry as a whole and expenditures on new plants' equipment as addition to the industry's capacity levels.

(iv) Technical parameters of economic production functions linked to the engineering production functions, based on engineering variables and their properties which are linked to the economic variables.

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23 Here, the terms, activity, process, stage of operation are synonymously used as they may refer to an equipment or a series of equipment, though distinctions of them are observed in Koopmans, Barna Tibor and Manne A.S. and Markowitz.


Because the relevant data are scanty generally in underdeveloped countries, it is not always possible to construct and choose these alternative types of estimates. They may also serve as supplementary to each other, for different applications of the dynamic input output analysis.

4.4.1.1 Incremental coefficients - an approximation

Most of the firms under investigation are of recent origin as seen from Table I of Chapter III, and the growth of the industry, as observed in Chapter II, is also of very recent origin. Replacements and additions to capital stock do not arise as most of the units are 6 to 7 years old. All these new units borrowed modern technology, though the possibility of holding some second hand imported equipments for the reasons of foreign collaborations cannot be ruled out. As there are no significant technological changes during this short period of 6 to 7 years either at the industry level or in any of the firms' processes, all the derived average coefficients may serve as incremental coefficients, with the assumption of only new capital and new technical knowhow are installed during the period.

4.4.2 Classification and aggregation

for sector specification

In the construction of input output structure of the

25 Apart others already referred on this problem, see (a) Yamada Isamu, Theory and applications of Interindustry analysis, Tokyo, Japan, Chapter 2 - Aggregation problems, pp. 16-48.

(b) Balderston T.B., and Within, T.B., "Aggregation in the input output models" in Economic Activity Analysis (ed.) by Oscar Morgenstern, pp. 79-114.

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sectors in an economy, the usual practice is to follow either an industrial or a trade classification scheme to specify the sectors of the economy. The industrial classification attempts to group together economic activities which are akin in terms of the technological process adopted. The unit of classification is an 'establishment', which is engaged in one or predominantly one kind of economic activity. Similarly, for the trade or commodity classification, the unit of classification is the commodity that enters into trade. Obviously, these two classifications serve different purposes. If the units of production are of single process type, and produce a single product, then two types of classifications would have satisfied the definition of the most disaggregative sector for input output analysis.

But, in actual practice, this hypothetical situation does not hold good as there are many multiproduct and multiprocess units of production. These give rise to problems of product mix, process mix and product multidimensionality for the purpose of sector specification. These practical problems are dependent on the industry or trade classification schemes for sector specification. This is so because the classification

(d) Barna, Tibor, "Classification and Aggregation in input output analysis".
(e) Malin Vaud, Edmond, "Aggregation problems in Input output models", both (d) and (e) are in The Structural Interdependence of the Economy, ed. by Tibor Barna, John Wiley and Sons, Inc., New York, 1954, pp. 175-202.
schemes are some statistical aggregation of the processes and products of the production units to form sectors, mostly based on horizontal integration, vertical integration, exclusiveness, demand complementarity, price proportionality and partial horizontal or vertical integration principles for different purposes. They depend on data availability on the individual sectors. All these principles of aggregation are not complements to each other in specifying a homogeneous sector.

4.2.1 The disaggregative input structures

The practical problems of allocating the actual inputs into the frame of the classification chosen, have been encountered by various researchers. These difficulties are also due to insufficient knowledge of the certain inputs due to different procedure of describing the financial accounts of different firms. Lack of reliability on them also bring insurmountable difficulties of classification and aggregation. However, maximum possible details of the transactions are collected at the firm level to compute the disaggregative input structures (see Table 4 in Appendix A). As the most disaggregative input table for 1963 under preparation of Gokhale Institute of Politics and Economics (G.I.P.E.) is based on 241 G.I.P.E. sectors, the input structures of firms and processes are presented with a suitable aggregation of the

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inputs, according to G.I.P.E. 241 sector classification. The corresponding ASI classification is also given for reference sake.

4.4.3 Concept of output of an enterprise or a firm

It is the aggregate of products of labour suitable for industrial and personal consumption produced by an enterprise as a result of its industrial production activities during a defined period.

4.4.3.1 Different types of products as accounting concepts of the firms

(i) Finished products are those, which are manufactured by the firm for delivery outside. (ii) Semifinished goods are those, that have to be further processed (by a technological process) in other shops or have to be transported to the assembly shop of the same firm. Semifinished goods like the finished goods have to conform to established norms or technical specifications. In forging units, die blocks waiting for customers' approval to deliver to forge shop and all rough forgings held at other shops for further requisite operations are semifinished goods. At each stage, they have to conform to requisite technical specifications and tolerances. (iii) Goods in process are those, the productions of which have not yet been completed at a given moment and are still in process in the shop. As the die blocks preparation involves long gestation period, the die blocks will be in continuous process of the activities of the die shop at any given moment.
4.4.3.2 **Gross output** of an enterprise consists of all finished, semifinished goods and goods in process turned out during the reporting period by the enterprise, using its materials as well as materials supplied by customers. It represents the final results of industrial production activities of an enterprise and it is the output corresponding to all inputs consumed during the year.

**Accounting data for Gross output of a firm as a balancing identity**

<table>
<thead>
<tr>
<th></th>
<th>Opening balance</th>
<th>Manufactured during the year</th>
<th>Sold or awaiting sale during the year</th>
<th>Closing balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Finished goods</td>
<td>( F_O )</td>
<td>( F_M )</td>
<td>( F_S )</td>
<td>( F_C )</td>
</tr>
<tr>
<td>2. Semifinished Goods</td>
<td>( S_O )</td>
<td>( S_M )</td>
<td>( S_S )</td>
<td>( S_C )</td>
</tr>
<tr>
<td>3. Goods in process</td>
<td>( G_O )</td>
<td>( G_M )</td>
<td>( G_S )</td>
<td>( G_C )</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>( m )</td>
<td>( s )</td>
<td>( c )</td>
</tr>
</tbody>
</table>

Gross output \( = m = s + c - o \)

Non-availability of data on either stocks is considered as that the difference between the closing and opening balances of them is zero. If the total production alone is given without any details either on sales or on stocks, then the total production is taken as gross output.
4.4.4 Secondary products and joint products

It is occasionally customary to classify establishments according to their primary products, with the result that, when establishments and/or inputs are aggregated to form sectors, the output of the sector may consist of one or more primary products, several secondary products and joint products. While several classes of secondary products can be distinguished, only those classes of secondary products whose production is technologically independent of the primary product may be referred to here as secondary. Products, which are the output of a single process same as of the primary product, fall into the category of joint products.

As we are to deal with only one joint product, scrap, for which there is no primary product industry, in the computation and presentation of input structures of firms in this industry, all those problems and methods are not attempted for review but only one method is followed. Scrap is treated as a dummy industry product, against which sector, it is shown as a negative input in the column vector of steel forgings and as a negative output of row vector of scrap or dummy industry.

In the gross output, scrap has not been included while computing the input structures. For comparison purposes, another set of input structures based on the gross output inclusive of scrap value, also are arrived at. There is not much divergence between the two sets of input structures and only the former set of input structures are presented.

4.4.5 **Subcontracting jobs**

Subcontracting may be defined as the practice of one firm contracting with another to manufacture some part of an entire product and/or to perform certain services of industrial nature, like finishing, machining, shot blasting, steel cutting etc. for which materials might be supplied and some cash payments might be made for these subcontracting jobs. These subcontracting jobs are broadly known as (1) work done by others and (2) work done for others in the accounting terms of the firms. One of the methods followed is to consider the 'net work done for others' to be in the nature of value added and adjust the value of total output accordingly in the construction of input output tables.28 In such cases, inputs like fuel and auxiliary chemicals are divided by adjusted value of the gross output and primary materials are divided by the original gross output. This is, however, an approximate procedure since the netting process assumes both 'work done for others' and 'by others' to be similar in their input structures. In this detailed industry study,

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the following list of subcontracting jobs are adjusted for
outputs and inputs based on the nature of job and the indus-
trial practices on such jobs.
4.4.5 (1) Work done by others

(a) Machining done by others: Generally the machining
jobs are subcontracted to small establishments employing
less than 10 persons and using power. Small establishments
have specialized on a few equipments, such as lathes, milling,
drilling, planing and shaping machines with skilled labour
on the machines. The establishment charges for these small
units are relatively less as it contains a maximum of one
manager and ten labourers. They do specialization on partic-
ular jobs like lathe work, tooling, drilling, piston rod
machining, shaping, planing and other machining jobs. In
general, small establishments are widely spread all around
industrial complexes as ancillary shops to big manufacturers.
Forging firms also give some of their machining jobs to these
small establishments, depending upon the urgency of the job
and nonavailability of equipment and tools at that time. The
practice of subcontracting is also because of certain economies
of getting a job done by small establishments of specialized
nature, compared to their doing the same job in their large
shops.

In the accounts of forging units under investigation,
the total value of 'Machining charges done by others' is
shown as a single expenditure item and no details of the
inputs of this expenditure are known. If the actual input
structures of these subcontracting jobs are available, they will be of immense use to refine the input structures of the sectors in the construction of input output tables. However, the details of the inputs that would cover the machining charges if the same jobs are to be done by the forging firm, are collected. These estimated inputs are added to the corresponding inputs of the firm to correspond with the value of gross output.

(b) **Steel cutting done by others**: A forging firm not having the facility of steel cutting equipment finds it convenient and economical to subcontract this job to small establishments, specializing in sawing, shearing and cutting steel and other alloys. Similar method for adjustment in the corresponding inputs of steel cutting, as it would have been done by the firm, is followed in this case also, to correspond with the gross output.

(c) **Repairs and maintenance done by others and by themselves**: As there are various types of repairs and maintenance activities, the details of the inputs corresponding to each of those types of repairs and maintenance are not known and they are likely to vary depending on their nature. For lack of these details, no adjustments are carried out on the corresponding inputs. It is shown as a single row sector element which is distinguished from the 'repairs and maintenance done by themselves' treated as a separate row sector element in the column input structures of 'steel forgings' sector.
4.4.9 (2) **Works done for others**

(a) **Forgings done for others when steel is supplied by customer**: Some customers are particular in supplying their own steel to the forging unit to manufacture their forging requirements. In such cases, the forging unit charges a price, exclusive of the steel price on those forgings, which is usually known as fabrication charges. As such the total value of production of the unit is less to the extent of the total cost of steel supplied by customers and used in process during the year. Similarly, the total cost of steel in the accounts of forging unit is also less to the extent of cost of steel supplied by customer and used in process during the year. But, the total of all other inputs' values is more to the extent of those fabrication charges.

One can think of two alternative adjustments to this problem: (i) **Deduct the corresponding additional inputs' values of these jobs from the corresponding total inputs values inclusive of the former**, so that the net resulting inputs details will correspond with the output exclusive of fabrication charges, as if those jobs are not done by the firm. Apart from the difficulty in identifying the corresponding inputs' values, such an adjustment is not so useful as some firms are doing more of these jobs depending mainly on customers' steel.

(ii) **Add an estimated cost of steel supplied by customers to the total value of steel, and to the total value of production, so that all inputs including steel will correspond with**
the gross output of the forging firm. The estimation of steel is the cost of steel if it had been purchased by the forging unit. Tonnage of customers' steel consumed is known from the records of the firm and approximate prices of the requisite steel specifications are suggested by the officials of the firm, for estimation of the value of customers' steel. The second method of adjustment is carried out for the reasons of its merits.

(b) Shot blasting done for others: Shot blasting is a process done on two types of special equipments to remove the scale and slug on the surface of forgings and castings. One type of equipment is known as wheelslabator and the other is a heavy shot blaster. Only two firms under investigation have got these special equipments, with different capacities. This is a work of industrial nature, performed on customers orders for goodwill and other reasons, not connected with the regular production activities. As the firm finds spare capacity on these equipments after shot blasting their own forgings, it earns by accepting these subcontracting jobs. These receipts of shot blasting done for others are shown as a single item in the current accounts of forging firm. These receipts are not included in the total value of production of the forging unit. But the inputs used in this process are included in the corresponding inputs. As such, the inputs and outputs of the firm are not corresponding to each other. To arrive at the proper input structure on comparable basis with other firms' input structures, it is necessary to make
adjustments on the input structure of the firm if it has not incurred those inputs corresponding to the shot blasting jobs done for others. The estimated values of inputs (being suggested by the officials of the firm) corresponding to shot blasting done for others are deducted from the corresponding total inputs values of the firm. The resulting inputs correspond to the gross output of the firm.

(c) Crankshaft machining done for others when crankshafts are supplied by customer

The crankshaft machining facility is a special feature of a single firm. Because of spare capacity available on those equipment, the forging unit accepts others' crankshafts for machining and get the receipts for the service. The adjustments for this problem are just similar to that of shot blasting done for others as the nature of the problem in both the cases is the same.

4.4.5 (3) Role of subcontracting jobs for sector specification and the stability of input structures

While there may be economies or diseconomies in subcontracting the types of jobs listed in relation to manufacturing or performing the services with their own all ancillary shop facilities within the forging units, both of these pose different problems in respect of sector specification and the stability of input structures. If one distinguishes each specialised process by horizontal integration of similar processes, like machining, shot blasting etc. as a sector, then there will be problems of product mix as the final
demands of the distinct products that are processed are fluctuating. If the fullfledged forging units equipped with all ancillary shop facilities are aggregated as a sector then there will be problems of process mix because of the changes in techniques in vertically integrated different processes. In practice, some jobs are subcontracted, while others done within the factory for the same process like machining, shot blasting etc. Because of the different industrial practices, the problems of stability in input coefficients due to different levels of scale of operation of the subcontracting units are often not taken into account.

Such of these problems are insurmountable for classification of the units of analysis when the reality is quite far from the rigidities of the aggregation or disaggregation for sector specification in the input output analysis.

4.4.6 Producers' and Purchasers' Prices

The transactions in the input output tables are generally valued at either the price received by the producer or at the price paid by purchaser. The difference is composed of marketing costs, which include such items as transport costs, which include such items as wholesale and retail trade mark ups, insurance and ware house costs and net indirect taxes. The sum of these components of the difference between producer price values and purchase price values of the transactions, is broadly termed as distributive margins.

As the distributive margins are institutional rather than technological in nature, a separate sector specification for the distributive margins grouped together, is not so stable as other sectors in the context of input output analysis. While there are relative merits of both the sets of tables at producers' prices and purchasers' prices, input output tables at producers' prices are generally preferred for the stability of input structures of the sectors.\(^{30}\)

For want of data on distributive margins for each using industry to make adjustments on input structures at either of the prices, one may have to assume that the ratio of producers' to purchasers' prices will remain same for all using industries. However, a recent study\(^{31}\) brought out the percentage distributive margins at producers' prices in the organized manufacturing sectors in India 1963, at an aggregated level of 21 x 21 sectors.

In this industry study, we have the gross output at producers' price, whereas the inputs are at purchasers' price. Data on the details of these distributive margins on the inputs or on the outputs are not available as the firms do not account for them separately. Even the ratios


of producers' to purchasers' prices of the inputs specially used in this industry are not known from any study, as this industry is to be specified at a more disaggregative level than Venkatramaiah's 21 x 21 sectors study. His study, however, provided the ratios of producers' to purchasers' prices of the inputs of 200 ASIC sectors, aggregated over all using industries.\textsuperscript{32} They are used to deflate the input structures so that both the inputs and outputs correspond to producers' prices. Similarly, by getting a single purchasers' price of steel forgings irrespective of its variations in respect of different users, the ratio of purchasers' to producers' prices of steel forgings is used to inflate the input structures, so that both the inputs and outputs correspond to purchasers' prices. The latter set of input structures of steel forgings at purchase prices is attempted as these can be incorporated in the Input Output Table for 1963 at purchasers' prices.\textsuperscript{33}

4.4.7 Adjustments to changes in prices

These adjustments in input structures, whether at producers' prices or at purchasers' prices, are needed, especially when the input output table of one particular year (1963) is required to be made use of, for any objective of the study. To compare the input structures of different firms over years

\textsuperscript{32}Unpublished ratios are used here as they are the ratios used for 241 x 241 C.I.F.E. sectors input output table for 1963. The ratios utilized are given in Table 11, Appendix A.

\textsuperscript{33}See, in Chapter V, the aggregated 66 x 66 sectors input output table at purchasers' prices of 1963.
also, these adjustments to price variations of inputs and outputs are required. For this purpose, 1963 is taken as the base year as it also refers to the year for which the latest input output table is available. Otherwise, all these input structures represent at current producers' prices as instantaneous production functions of the firms and processes. These structures are for the years 1963 to 1967, while only a few firms have input structures for some of these 4 to 5 years, without any uniformity of the accounting periods. Many of the firms have the structures for the latest year 1966-67.

The detailed price data on inputs and outputs of steel forgings industry for different years 1963 to 1967 are scanty to make proper adjustments on column input structures and on row input coefficients of steel forgings. However, efforts are made to collect price indices of aggregate inputs and outputs from two sources and the necessary adjustments are carried out. 34

4.4.8 Competitive and complementary imports 35

The competitive imports, which could be produced indigenously but whose input structures are not known, are assumed

34 See Chapter V. Two sources of data: (1) Index numbers of wholesale sale prices in India (Revised series) for the years 1963 to 1967, Office of the Economic Advisor, Ministry of Industry, Government of India, New Delhi. (2) Statistics for Iron and Steel Industry in India, Hindustan Steel Limited, Ranchi, India, 1966.

to have the same input structure as their Indigenous production. As such, the inputs of competitive imports are clubbed with those of corresponding indigenous sectors' outputs. There is an error in not treating separately the competitive imported inputs and indigenously produced inputs, mostly because such a detailed data are not available in the census reports (Annual Survey of Industries). If these indigenous and competitive imported inputs are separable, the latter can be treated as negative final demand also.

In this study it is attempted to show the imported inputs distinguished from the indigenous inputs whenever the details are available for presentation without the need of aggregation. This may serve the purpose of noting the import content of the inputs structure of this industry (See Table 4, Appendix A). If the distinction in treating the competitive and complementary imports in the input output tables is not made, firstly, errors in classification arise and its repercussions on the results; secondly, the analysis has to work as if those complementary imported goods also have the same input structure as those of competitive goods. In this study, there are no complementary imports.

4.4.9 Capital coefficients

The increments of assets, that is investment, associated with maintaining and increasing capacity are required to be distinguished in computing fixed capital coefficients. By linking these with the current table, it would be possible to convert this investment demand, like any other component
of final demand, into additional output requirements. Similarly, the inventories of working capital coefficients table provide for the additional stocks, needed to sustain the capacity of industry, as well as for the inputs actually absorbed in the production.

Since the industry, in practice, is likely to have a product mix of its own, there would arise a necessity of aggregating different capital goods, though they are produced in the same industry. The prices may serve as weights for aggregation of the capital goods to get the replacement value at the current producers' prices. Otherwise, the purchase values in different periods may be adjusted to the replacement values at current prices. Even the estimation of capacity becomes difficult as it is a function of the varying product mix of its own.

(i) The concept and measurement of capacity

The concept of capacity is related to the maximum amount which an industry can produce with its existing endowment of fixed factors. The concept of capacity presupposes some normal form of working, such as two shifts of eight hours a day with the machinery running at a given (norm) speed. It is reasonable to suppose that in perfect competition the engineering design of the plant with a homogeneous product


would ensure production at which average cost would be minimum. In such a case, the sum of the capacities for all establishments in the industry would give a measure of industry’s capacity. In practice, an establishment may produce more than one product so that the limiting fixed factors depend on the product mix, which in turn depends on the relative profitability of the different products.

Klein has suggested an approach to the measurement of minimum average cost from the cost function, which necessarily passes through successive phases of decreasing and increasing marginal cost, given by a sigmoid curve. But the data for such an investigation are difficult to get.

In this study, the capacity is taken as the maximum production possible with the installed equipment under normal conditions during the period. For this purpose, in some cases, the project report capacity is taken, while in other cases, the total scheduled production, or the maximum achieved production, or the actual production of the period is made use of, as there are no data uniformly available from all firms over the years.

(ii) **Maintenance of capacity : Depreciation and replacement**

The gross capital ratios assume that a piece of equipment continues to be used at the same degree of utilization and efficiency until it is discarded, while the net capital

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ratios assume that depreciation allowance do provide an accurate measure of the life and age of machinery.39

(iii) The extension of new capacity arises because of the fact that the technical changes may alter the structure of the plant. An entirely new plant may be built; a balanced extension may be added to an existing plant; an unbalanced extension may be made consisting, for example, of removing a bottleneck; or capacity that has been idle for sometime may be brought back into service.

In this industry study, as all firms are of recent origin, the replacements of equipment capital and extensions of new capacity do not arise.

Gross values of fixed capital goods are taken for the purpose of computing fixed capital coefficients per unit capacity of the firms. Similarly, the working capital coefficients per unit output of the firms are also computed.

4.4.10 Some assumptions and limitations regarding original financial data are necessarily to be stated in computing these inputs and capital structures:

(1) It is assumed that the firms under investigation, computed their accounts in a comparable fashion, though in practice this is not so.

39 An analysis of the age composition and expected life with reconditioning and without reconditioning of the capital goods, providing the investment pattern and the replacement demand of all disaggregative capital goods, is attempted in a study by R.K. Koti and V.V.N. Somayajulu, "Capital Goods in Machinery and Metal Products Industries", presented to the "Industrial Economics Seminar" held in Bombay.
(2) The financial accounts open to investigation are assumed to be reasonably accurate records of the firm's actual transactions.

(3) Many repairs which may add years to the life of the machines, are not considered part of capital accounts, rather are entered in the current accounts.

(4) The different firms are assumed approximately of the same degree of integration for comparison of capital structures between firms and over years.

(5) No price adjustments to different capital goods over the years 1963 to 1966-67 are carried out, as the price data on capital goods are scanty and this period of 4 years is not known for significant price changes of capital goods.

(6) Measurement of capacity uniformly to all firms could not be attempted due to paucity of requisite data.

4.5 Analysis of the input and capital structures of firms and processes

The structural parameters of instantaneous production functions of the firms and processes in steel forgings industry in India, usually termed as input and capital structures, are evaluated at a very disaggregated level, after making all requisite adjustments for refining them. The structural coefficients of current inputs are presented at producers prices in Tables 1 and tables in Appendix A. The structural coefficients of fixed and working capital are presented in tables 2, 3 and Appendix A tables 5 and 6, without adjusting
for distributive margins, as such data are not available from any source.

Here, it is intended to bring out the importance of the distinct products of the firms, as distinguished in Chapter VI and VII, with respect to quantitative and qualitative features of the product dimensions, and their impact on the distinct structural parameters of the firms. The following 3 tables present a relatively aggregative input and capital structures of (i) Die forging firms, (ii) open or free forging firms, (iii) wheel sets unit and (iv) sleepers unit. They relate to the latest year 1966-67 for which more detailed data are available from the individual firms. Only one firm has the latest year as 1965-66, while other firms have the latest year as 1966-67. It is for these latest years of the firms, the details on product dimensions of the forgings of the firms are also available. Only those firms are chosen for presentation in table 1 for which data on product dimensions are analysed in Chapters VI and VII. Input structures of 4 die forging firms, 3 open forging firms, one wheel sets unit and one sleepers unit are presented in table I. Fixed capital and working capital structures of the units, for which data are available, out of the listed 9 production units, are presented in the respective tables 2 and 3.

4.5.1 Classification for Inputs

While the detailed inputs and capital structures are
presented in the disaggregative tables (Appendix A) most of the input details are aggregated for presentation, according to the Gokhale Institute of Politics and Economics (G.I.P.E.) 241 sector classification is also adopted for classifying the inputs of the firms and product groups in Chapter VII. Based on the 241 sectors classification scheme, the most disaggregative input output table for 1963 is being prepared by Mathur, P.N. and others. However, no classification scheme is adopted, in the following analysis, for fixed assets and working capital assets as the available data are very aggregative.

4.5.2 Analysis of input structures

Steel is the major input in this industry. Steel input coefficient varies from 0.315849 to 0.347310 for die forgings' firms and from 0.233187 to 0.469925 for open forgings' firms. The ingots and blooms' input coefficients for wheel sets and sleepers units are as high as 0.454224 and 0.477926 respectively. Based on the variations in steel input coefficients, the die forging firms are necessarily to be distinguished from open forging firms. These are required to be distinguished also due to distinct technical features of their processes, products and materials as enlisted in Chapter III. Because hundreds of grades of steel specifications are being used in the industry, some firms specialize in some products requiring particular sets of steel grades. Due to capacity limitations of equipments and other ancillary facilities, the quantitative and qualitative features of product dimensions, viz. pise
weight and tensile strength, and/or the nature of the products, are restricted to certain ranges of these product dimensions. These have been examined in Chapters VI and VII. The input structures of the wheel sets unit and of sleepers unit are distinguished from each other and all other firms as seen in Table I. The broad details of the steel inputs, viz., carbon, alloy, die blocks, die tool, ingots, blooms, and their input structures are given in the detailed tables in Appendix A.

Regarding fuels, die forging firms are using mainly oils like furnace oil, light diesel oil and high speed diesel oil, while the open forging firms, wheel sets unit and sleepers unit are using gases like coke oven gas, blast furnace gas, etc. This is partly because of locational factors also. The fuels' coefficients vary from 0.016848 to 0.052117 for die forging firms, from 0.030219 to 0.167572 for open forging firms and are as low as 0.014127 and 0.003429 for wheel sets and sleepers units respectively. These differences are also to be explained by the product dimensions. Similar variations between firms are clear regarding coefficients of electricity, consumable stores or productive supplies, repairs and maintenance as they may be accounted for the variations in the product dimensions' ranges of the firms. These are examined in Chapter VII.

4.5.3 Analysis of the capital structures

Plant and machinery coefficient per unit rupee worth
capacity ranges from 0.537413 to 1.086299 for 3 die forgings' firms and from 0.647051 to 0.887256 for 2 open forgings' firms. Similar distinctive features of die forgings, open forgings, wheel sets and sleepers units are clear from tables 2 and 3 in respect of other fixed assets and working capital structures respectively. These differences are partly due to various levels of vertical integration of the processes in the different shops of the firms. These distinct technical features of the firms may get reflected in the product dimensions of their products. These have not been examined in the present study as the data are very aggregative, scanty and not uniform over firms and assets.

4.5.4 Concluding remarks

The similarity of some input and capital structures is partly because of the levels of aggregation and the nature of evaluation methods due to conceptual and practical problems enlisted in this Chapter IV. The distinctive discrepancies in the nomenclature and nature of inputs used by the firms are mainly due to nature of the products of the individual units. The distinct quantitative and qualitative features of the product dimensions and their ranges in the firms may make a difference in the nature of their products. Such detailed current input structures and capital input structures - both of working capital and fixed capital, are basic to the disaggregative dynamic input output models in planning for investment and production scheduling in the individual plants, industries and the economy.
Table 1. Input structures of firms in steel forgings industry during 1965-67 at producers' prices

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>GIPE Sector No.</th>
<th>ASIC Sector No.</th>
<th>Description of Inputs</th>
<th>Die Forging Firms</th>
<th>Open or Free Forging Firms</th>
<th>Wheel sets Firms</th>
<th>Sleeper Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62</td>
<td>280-1</td>
<td>Printing and Stationery</td>
<td>-</td>
<td>0.000182</td>
<td>0.000983</td>
<td>0.002768</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>321</td>
<td>Fuel oils</td>
<td>0.017290</td>
<td>0.016846</td>
<td>0.023488</td>
<td>0.052117</td>
</tr>
<tr>
<td>3</td>
<td>91</td>
<td>329</td>
<td>Coke oven gas etc. and Blast furnace gas</td>
<td>0.000618</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>59-77</td>
<td>311</td>
<td>Chemicals</td>
<td>0.000896</td>
<td>-</td>
<td>0.000074</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>110</td>
<td>341-2</td>
<td>Steel</td>
<td>0.313849</td>
<td>0.347310</td>
<td>0.344313</td>
<td>0.323774</td>
</tr>
<tr>
<td>6</td>
<td>169, 370-2; 170, 171</td>
<td>-1</td>
<td>Telephone charges</td>
<td>-</td>
<td>0.000180</td>
<td>0.001034</td>
<td>0.003248</td>
</tr>
<tr>
<td>7</td>
<td>200</td>
<td>411</td>
<td>Electricity charges</td>
<td>0.006527</td>
<td>0.014274</td>
<td>0.015674</td>
<td>0.009309</td>
</tr>
<tr>
<td>8</td>
<td>200</td>
<td>512</td>
<td>Oxygen and Acetylene</td>
<td>0.001643</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>233</td>
<td></td>
<td>Consumable stores or productive supplies</td>
<td>0.001506</td>
<td>0.007643</td>
<td>0.008796</td>
<td>0.046897</td>
</tr>
<tr>
<td>10</td>
<td>233</td>
<td></td>
<td>Repairs and Maintenance</td>
<td>0.001231</td>
<td>0.007170</td>
<td>0.031897</td>
<td>0.069926</td>
</tr>
<tr>
<td>11</td>
<td>236</td>
<td></td>
<td>Safety Equipment</td>
<td>0.000322</td>
<td>-</td>
<td>0.000313</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>238</td>
<td>239</td>
<td>Transport</td>
<td>0.000478</td>
<td>0.000305</td>
<td>0.016837</td>
<td>0.001628</td>
</tr>
<tr>
<td>13</td>
<td>241</td>
<td></td>
<td>Water</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>14</td>
<td>240</td>
<td></td>
<td>Distributive margin</td>
<td>0.073742</td>
<td>0.084263</td>
<td>0.122453</td>
<td>0.143194</td>
</tr>
<tr>
<td>15</td>
<td>-</td>
<td></td>
<td>Scrap</td>
<td>0.001676</td>
<td>0.016512</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>109</td>
<td>341-1</td>
<td>Insects and Blooms</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>93</td>
<td>331-2</td>
<td>Refractories</td>
<td>0.384401</td>
<td>0.523247</td>
<td>0.447178</td>
<td>0.407895</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>Gross value added</td>
<td>0.984011</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

Note. The (-) cells represent either zero quantity or nonavailability or both. However, they are treated as zero quantities for the purpose of analysis.
### Table 2. Fixed capital coefficients of firms in steel forgings industry during 1965-67 (all on 3 shifts basis capacity)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description of fixed capital</th>
<th>Die forgings firms</th>
<th></th>
<th></th>
<th></th>
<th>Wheel sets units</th>
<th>Sleepers unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant and Machinery</td>
<td>0.337413</td>
<td>0.631197</td>
<td>1.086299</td>
<td>0.887236</td>
<td>0.647051</td>
<td>N.A.</td>
</tr>
<tr>
<td>2</td>
<td>Electrical installation</td>
<td>0.007013</td>
<td>0.008304</td>
<td>0.048630</td>
<td>0.047721</td>
<td>0.001996</td>
<td>N.A.</td>
</tr>
<tr>
<td>3</td>
<td>Transport equipment</td>
<td>0.037160(a)</td>
<td>0.037160(a)</td>
<td>0.037160</td>
<td>0.32705</td>
<td>0.32705(b)</td>
<td>N.A.</td>
</tr>
<tr>
<td>4</td>
<td>Engineering Instruments</td>
<td>0.001272(a)</td>
<td>0.001272(a)</td>
<td>0.001272</td>
<td>0.33709</td>
<td>0.33709(b)</td>
<td>N.A.</td>
</tr>
<tr>
<td>5</td>
<td>Buildings</td>
<td>0.072765</td>
<td>0.028993</td>
<td>0.113463</td>
<td>0.145702</td>
<td>0.145702(b)</td>
<td>N.A.</td>
</tr>
<tr>
<td>6</td>
<td>Land</td>
<td>0.022653</td>
<td>0.028460</td>
<td>0.006979</td>
<td>0.000387</td>
<td>0.000387(b)</td>
<td>N.A.</td>
</tr>
<tr>
<td>7</td>
<td>Factory equipment and office equipment</td>
<td>0.002877</td>
<td>0.002815</td>
<td>0.018828</td>
<td>0.040040</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Furniture and Fittings</td>
<td>0.000393</td>
<td>0.007377</td>
<td>0.006483</td>
<td>0.00834</td>
<td>0.00834</td>
<td>N.A.</td>
</tr>
<tr>
<td>9</td>
<td>Railway Road sliding</td>
<td>N.A.</td>
<td>N.A.</td>
<td>0.008251</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>10</td>
<td>Motor cars and commercial vehicles</td>
<td>N.A.</td>
<td>0.023820</td>
<td>0.007972</td>
<td>N.A.</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Scooters and cycles</td>
<td>N.A.</td>
<td>0.000792</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>12</td>
<td>Other fixed assets</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>0.681568</td>
<td>0.767190</td>
<td>1.333339</td>
<td>1.194154</td>
<td>0.868188</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

N.A. Not available or there may not be any quantity in the respective cells. However, some adjustments are made for some cells as follows:

(a) Transport equipment and engineering instruments' fixed capital coefficients in Firms A and B are not available and the respective coefficients of Firm D are introduced.

(b) As N is a captive unit, the details on transport equipment, engineering instruments, buildings and land are not available and the firm J's coefficients on the corresponding items are introduced for firm N also.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description of working capital</th>
<th>Die forgings firms</th>
<th>Open forgings firms</th>
<th>Wheel sets unit</th>
<th>Sleepers unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuels like furnace oil, light diesel, high speed diesel oil, lubricants, etc.</td>
<td>0.006700</td>
<td>0.003797</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>2</td>
<td>Steels - carbon, alloy, die block, die tool</td>
<td>0.003576</td>
<td>0.427939</td>
<td>N.A.</td>
<td>0.02084</td>
</tr>
<tr>
<td>3</td>
<td>Semi-finished goods</td>
<td>0.344703</td>
<td>0.156307</td>
<td>N.A.</td>
<td>0.178111</td>
</tr>
<tr>
<td>4</td>
<td>Finished Forgings</td>
<td>0.061659</td>
<td>0.047010</td>
<td>0.039121</td>
<td>0.066583</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>0.916638</strong></td>
<td><strong>0.633073</strong></td>
<td><strong>N.A.</strong></td>
<td><strong>0.264498</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Power equipment</strong></td>
<td><strong>0.000145</strong></td>
<td><strong>0.000133</strong></td>
<td><strong>0.000110</strong></td>
<td><strong>0.000310</strong></td>
</tr>
</tbody>
</table>