MONOGRAPHS IN THE ECONOMICS OF DEVELOPMENT

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TOWARDS THE APPLICATION OF INTER-REGIONAL INPUT-OUTPUT MODELS TO ECONOMIC PLANNING IN PAKISTAN

August, 1960

S. M. NASEEM

THE INSTITUTE OF DEVELOPMENT ECONOMICS
OLD SIND ASSEMBLY BUILDING,
BUNDER ROAD, KARACHI.
(PAKISTAN)

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1. Introduction

In the static input-output analysis developed by Professor Leontief[1], the economy is regarded as a system of mutually interdependent industries linked by the flow of goods and services among them. The total output of an industry can be used either as an intermediate product by other industries (and itself) or for the purpose of satisfying "final demands."

The inherent advantage of the input-output model is that it emphasises the production relations between the various industrial sectors. By taking into account the inter-relations between different industrial sectors the input-output model is able to explain the functioning of the economic system in a very comprehensive and realistic way. For this reason it can be used as a tool for economic planning[2]. For instance, it enables us to predict the total output levels of each individual sector corresponding to a given bill of goods which the community may desire to consume and invest.

There are many directions in which the static input-output model can be extended. An important extension has been in the regional direction[3]. An inter-regional input-output model gives us greater insight into economic balance on a regional as well as national level. It also enables us to see the differential impact of a change in the national bill of goods on the production levels in different regions. In short, it provides us with regional breakdowns of the national aggregates comprising the over-all input-output system.

(1) W. Leontief, "The Structure of the American Economy, 1919-39," Oxford University Press, 1953, 2nd edition.

(2) For an excellent account of the use of the input-output model in economic planning, see H. B. Chenery, "The Input-Output Model", Economic Bulletin for Latin America, September 1956.

(3) Another extension of the static Leontief model is in the direction of the time dimension. A model which enables us to trace the time-path of investments is called a dynamic model. Both types of extension have been developed by Prof. Leontief in the "Studies in the Structure of the American Economy", Oxford University Press, 1953.

The present paper examines the two major inter-regional input-output models developed by Professors Leontief[1] and Moses[2]. In what follows, we compare the distinctive assumptions of the two models and show that, from the mathematical view-point, the Leontief model is, in fact, a special case of the Moses model. We then construct a new model which incorporates not only the basic features of the above two approaches but also additional features excluded by these models.

We have also investigated the applicability of such a general model to Pakistan, especially as a tool for inter-regional economic planning. As the two regions of Pakistan differ substantially in resource endowment, production practices and consumption patterns, it is only logical that an efficient planning model must take into account such regional differences. We have also examined the possibility of categorising different industries in both regions of Pakistan according to the inter-regional trading pattern which may be assumed from common sense approximation. A more rigorous categorization of Pakistan's industries will become possible once the empirical content has been sharpened. The basic question of data availability for the quantitative implementation of this model has also been discussed.

Since we are mainly concerned with the comparison of the basic structures of these models the understanding of the mathematical properties involved is clearly rather essential. We have, however, tried to keep the mathematics at a level which an ordinary reader can easily cope with. In this effort we have used a simple model to illustrate the properties of a general linear model and have employed it as well to derive the solutions of the other models. Moreover, we have adopted two major expository devices. The first is a diagrammatic representation of the various models; the second is the use of the concepts of Total Regional Demand (TRD) and Total National Demand (TND)—which are explained later. It is hoped that these two devices make a significant contribution to a clear exposition of the various models.

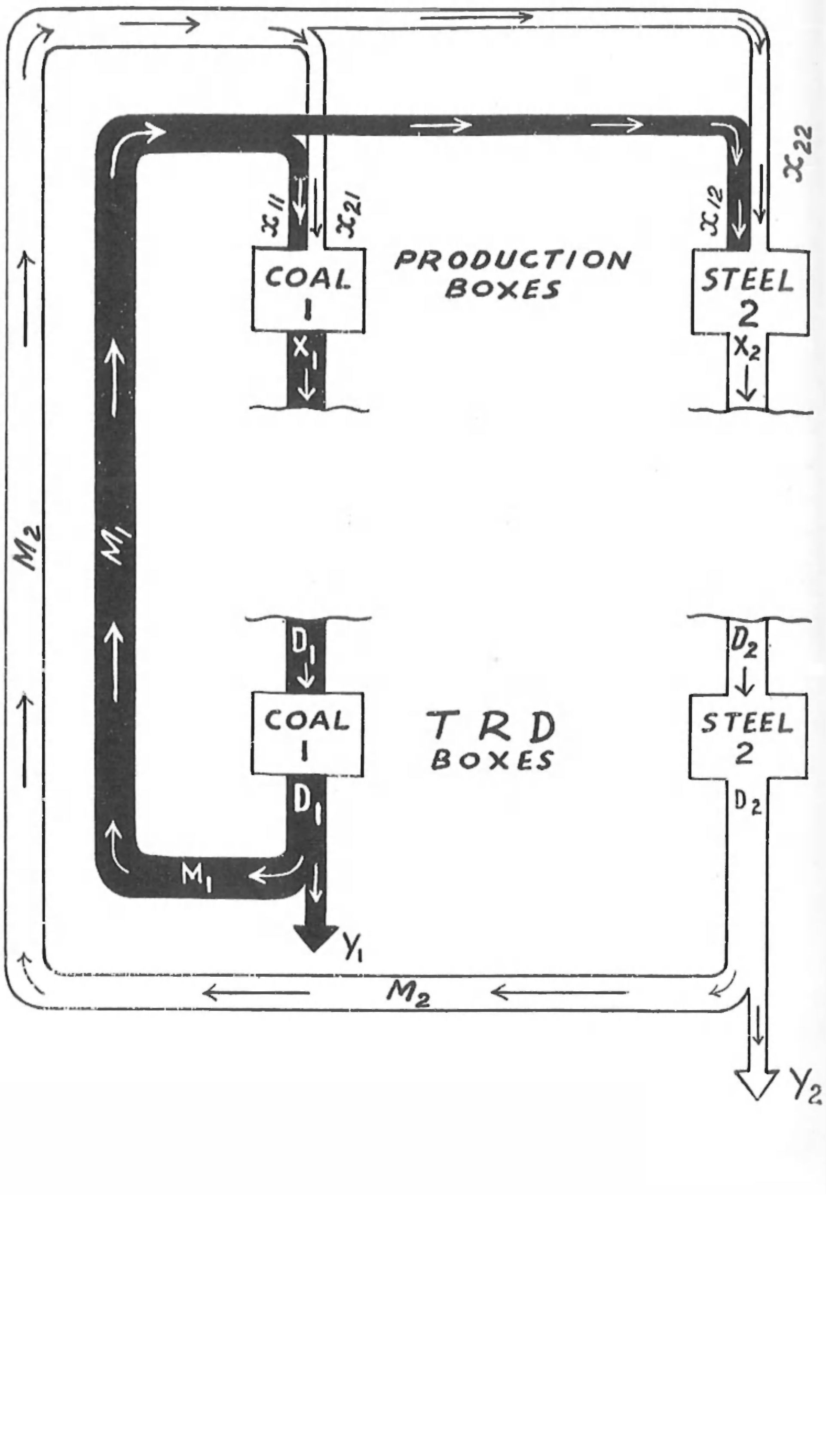
The original presentation of the two models discussed requires an understanding of involved and complicated mathematical appendices and is thus virtually inaccessible to the non-mathematical economist. A major aim of our exposition, therefore, has been to help the non-mathematical reader understand the basic mathematical structure of the various models discussed.

2. Total Regional Demand

In this section we shall elaborate the concept of total regional

(1) W. Leontief, "Studies in the Structure of the American Economy", op. cit.
(2) L. Moses, "Inter-regional Input-Output Analysis", American Economic Review, December 1955.

DIAGRAM I (a): The Composition of TRD for Two Commodities in a Region



demand for a commodity (TRD), referred to above. There are two aspects to this concept. The first aspect concerns itself with the way in which regional demands are *created* and the second with the way in which they are *satisfied*. Both aspects involve certain structural assumptions but we shall show that it is with respect to the second aspect that the assumptions in the various regional models differ.

The TRD for a commodity in a particular region is created by: (1) the demand for the commodity by all industries (including the one which produces it) for use as an intermediary factor of production and (2) "final demands" for it, i.e. demands by households and government for consumption and investment, and demand for exports.

In diagram 1(*a*), the creation of TRD for two commodities, coal and steel, in a particular region is illustrated. The *production* of coal and steel in a region is represented by the two boxes in the top row. We shall call them "production boxes". Inflows into these boxes enter from the *top* and outflows are released from the *bottom*. The direction of the flows is indicated by the appropriate arrows inside the pipes. The outflows from the bottom of the production boxes are the *total outputs* of each industry, viz. X_1 (total output of the coal industry) and X_2 (total output of the steel industry). The inflows from the top represent the intermediary factors of production, viz. x_{11}, x_{12} (i.e. the amount of *coal* used as an intermediary factor of production by the coal and steel industries, respectively) and x_{21}, x_{22} (i.e. the amount of *steel* used as intermediary factors of production by the coal and steel industries, respectively). In order to help visualise and clearly distinguish all flows we have used the colour black to represent coal and the colour white to represent steel.

The various industrial sectors are inter-dependent in the Leontief-type input-output model. It is assumed that there is an exact functional relationship between the requirements of one sector for inputs secured from another per unit of output of the former. The proportionality factors involved are called the production coefficients. Denoting the production coefficients by a_{11}, a_{12}, a_{21}, and a_{22}, we have

$$\text{(2.1)} \quad \begin{aligned} x_{11} &= a_{11} X_1; \; x_{12} = a_{12} X_2 \\ x_{21} &= a_{21} X_1; \; x_{22} = a_{22} X_2 \end{aligned}$$

Each of these equations describes exactly the nature of the dependence of the intermediary factors of production on the level of total output. When the total outputs, X_1 and X_2, are known the production co-efficients enable us to compute the regional intermediary factors of production, x_{11}, x_{12}, x_{21} and x_{22}.

The bottom row in diagram 1(*a*) comprises the "demand boxes" which help us to derive the TRD concept. The inflows into and the outflows from these boxes follow the same pattern as in the case of the production boxes, i.e. inflows at the top and outflows from the bottom.

There are two sets of outflows from the bottom of the demand boxes:

(a) *Final demands*, denoted by Y_1 (final demand for coal) and Y_2 (final demand for steel).

(b) *Intermediary demands*, denoted by M_1 (the total intermediary demand for coal) and M_2 (the total intermediary demand for steel). The total intermediary demand for a commodity consists of the intermediary demand of all industries for that commodity.

Thus we have,

$$\begin{aligned} M_1 &= x_{11} + x_{12} \\ M_2 &= x_{21} + x_{22} \end{aligned} \tag{2.2}$$

The T.R.D. for a commodity can now be defined as the sum of (*a*) and (*b*) above. Denoting the TRD for coal by D_1 and that for steel by D_2, we have:

$$\begin{aligned} D_1 &= M_1 + Y_1 \\ D_2 &= M_2 + Y_2 \end{aligned} \tag{2.3}$$

In diagram 1 (*a*) we can represent the TRD's by the pipes leading into the demand boxes from the top. The equations (2.3) can be diagrammatically interpreted as the equality of the inflows into the demand boxes (D_1 and D_2) and the outflows from the demand boxes ($M_1 + Y_1$ and $M_2 + Y_2$).

The final demand components (Y_1 and Y_2) of TRD are generally given as the data of the problem. The intermediary demand components (M_1 and M_2) can be computed with the help of equations (2.1) and (2.2). In other words, if we know the production co-efficients, a_{11}, a_{12}, a_{21}, a_{22} and total outputs, X_1 and X_2, we can compute M_1 and M_2 and thus determine the TRD completely. We have thus shown that the TRD for a commodity can be traced back to total output and final demand.

In the above, we have discussed the creation of TRD for a commodity with reference to a particular region only. The creation of TRD's in other regions follows exactly the same pattern. Diagram

DIAGRAM I (c): The Satisfaction of TRD for Two Commodities in the One-Region Case

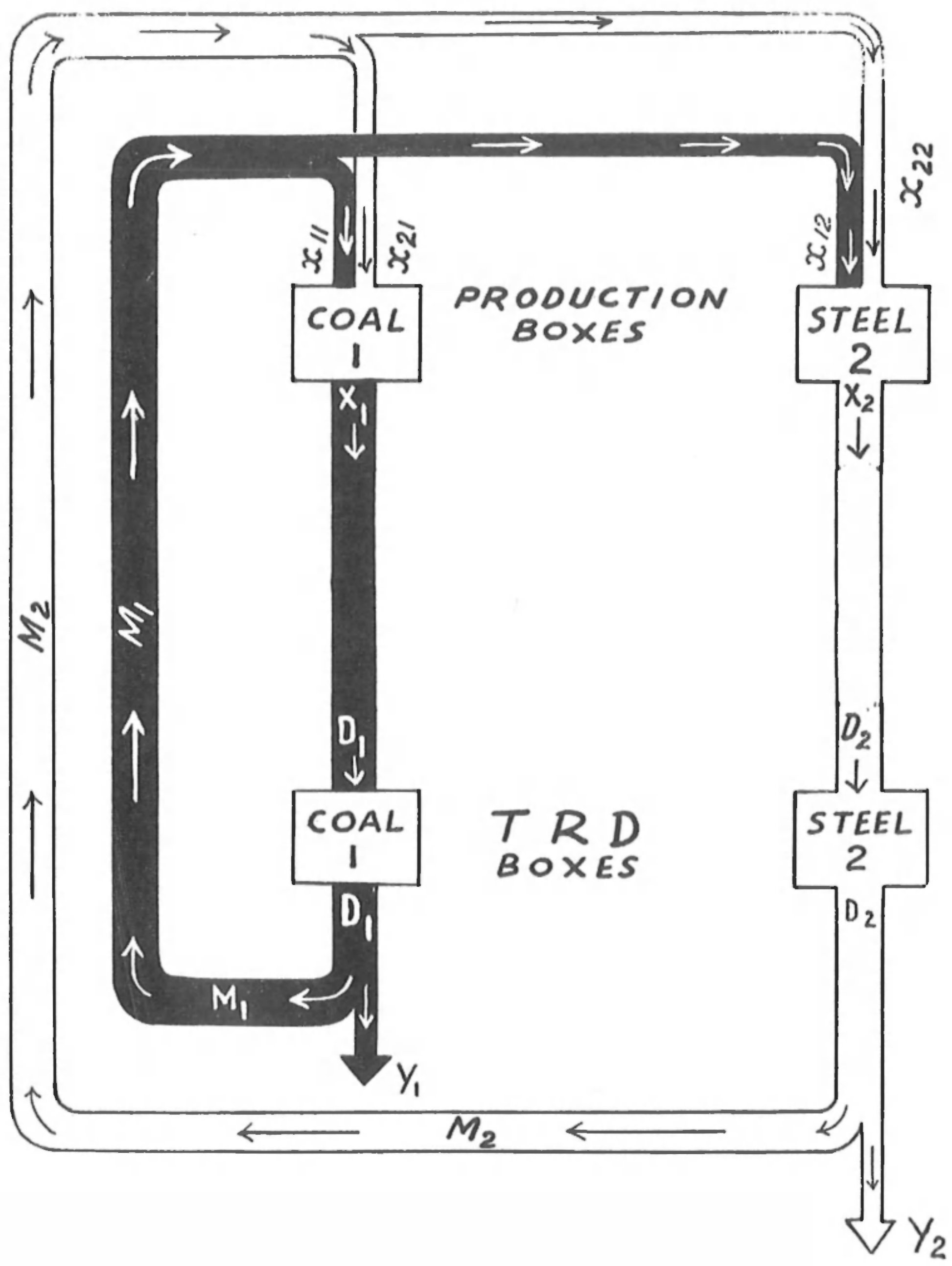
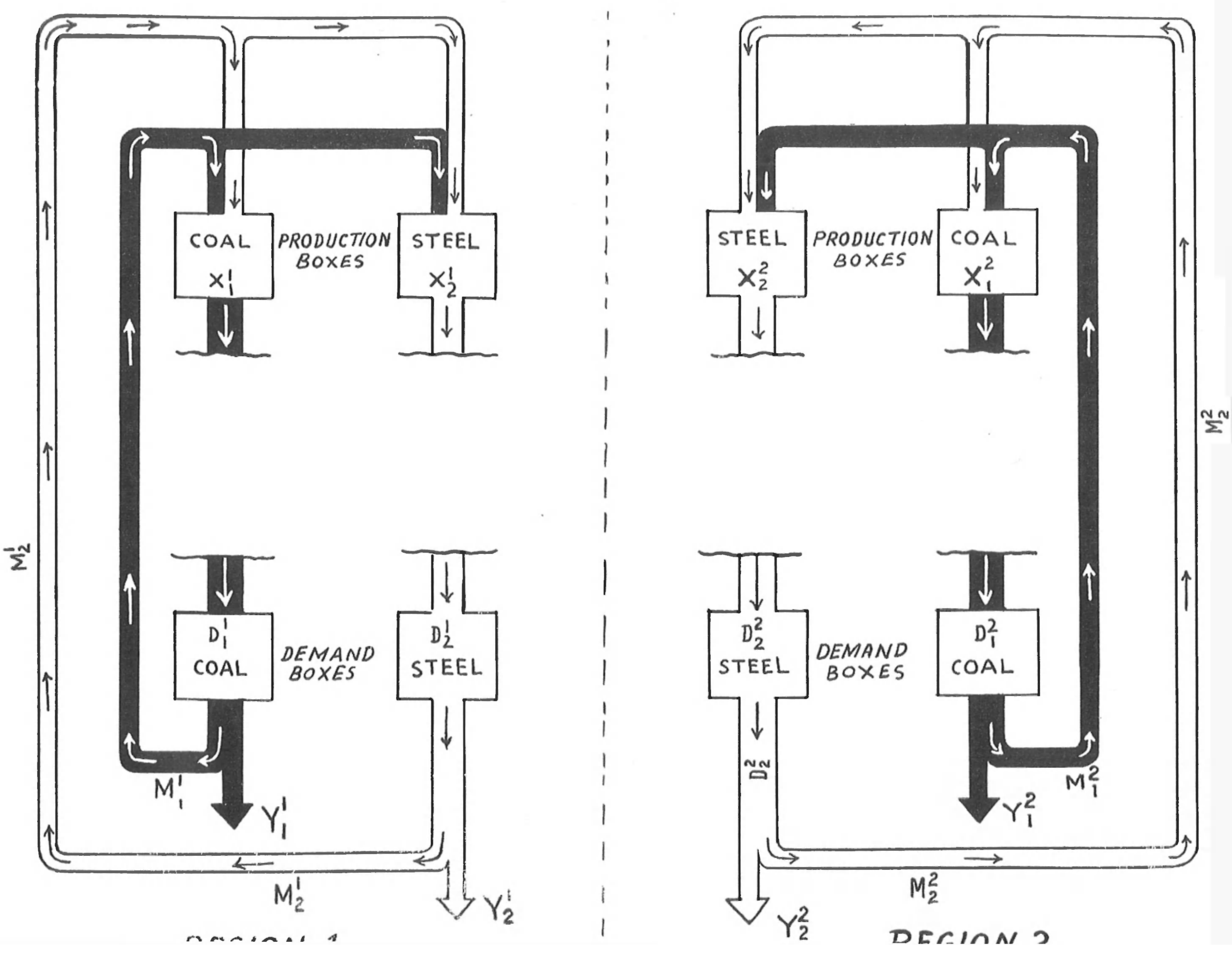


DIAGRAM I (b): The Composition of TRD for Two Commodities in Two Regions



1(*b*), for instance, shows the TRD for the same two commodities, coal and steel, in the two regions 1 and 2 which are separated by the vertical line in the middle of the diagram. Thus, with the exception of the newly-added regional dimension, this diagram has the same basic structure as diagram 1 (a). However, in order to distinguish the various *regional* flows, a superscript, indicating the region to which they belong, is added to each of them. Thus the two total regional outputs become X_1^1, X_2^1 and X_1^2, X_2^2, the 4 TRD's become D_1^1, D_2^1 and D_1^2, D_2^2, the eight intermediary flows become x_{11}^1, x_{12}^1, x_{21}^1, x_{22}^1 and x_{11}^2, x_{12}^2, x_{21}^2, x_{22}^2 and the four final demands become Y_1^1, Y_2^1 and Y_1^2, Y_2^2.

We may now consider the second aspect of TRD, i.e. the way it is satisfied. Let us first investigate the simplest case, i.e. when there is only one region in the economy. In this case the entire TRD for a commodity must be supplied from "within" the region. Diagrammatically this is shown in Diagram 2(c) by the pipes linking the bottom of the production boxes with the top of the demand boxes. As shown in the diagram the entire total putput of each of the production boxes flows directly into the corresponding demand boxes. In other words.

(2.4) $\quad X_1 = D_1$ and $X_2 = D_2$

The equations (2.1) to (2.4) give us the complete determination of the system in terms of total regional outputs and final regional demands:

$$(2.5)\quad \begin{aligned} X_1 &= a_{11} X_1 + a_{12} X_2 + Y_1 \\ X_2 &= a_{21} X_1 + a_{22} X_2 + Y_2 \end{aligned}$$

This can readily be seen to be the case of the Leontief static input-output model without a regional dimension.

If, however, there is more than one region in the economy, the satisfaction of TRD for a commodity becomes slightly more complicated. This is true because the TRD for a commodity in any region may now be satisfied not only by its own internal production but also by the production of other regions. For our 2-region (1 and 2) 2-industry (coal and steel) case this is illustrated in diagram 2. It can be seen that for any industry the demand boxes of the two regions are fed by the corresponding production boxes in *both* regions.

Taking the two regions together, the satisfaction of TRD's has a deterministic and an indeterministic aspect. The deterministic aspect arises out of the fact that for any commodity the *combined TRD's* in both regions must always be satisfied by the *combined total outputs* of the two regions. In other words,

$$D_1^1 + D_1^2 = X_1^1 + X_1^2$$
(2.6)
$$D_2^1 + D_2^2 = X_2^1 + X_2^2$$

The indeterminate aspect of the satisfaction of TRD's arises from the fact that it is not known what part of each region's TRD is satisfied by its own production and what part by the production of the other region. In other words, it is not known *a priori* what will be the *inter-regional trading pattern* for each commodity in each region.

But we do know the two accounting equalities involving the export and import pattern for each commodity in each region which must always be satisfied. The first is that a region's total exports will be the sum of all its exports (including those to itself). If we denote a typical inter-regional flow by X_k^{ij}, where i is the producing (or exporting) region, j the consuming (or importing) region and k the commodity being used. This can be written as:

$$X_1^1 = X_1^{11} + X_1^{12}$$

$$X_1^2 = X_1^{21} + X_1^{22}$$
(2.7)
$$X_2^1 = X_2^{11} + X_2^{12}$$

$$X_2^2 = X_2^{21} + X_2^{22}$$

These equations can be verified by diagram 2. The outflows from the production boxes go to demand boxes in the region itself or in the other region. The second accounting equation is that the TRD for a commodity in a region is satisfied by importing either from the region itself or from other regions. In terms of the notation already established this can be written as:

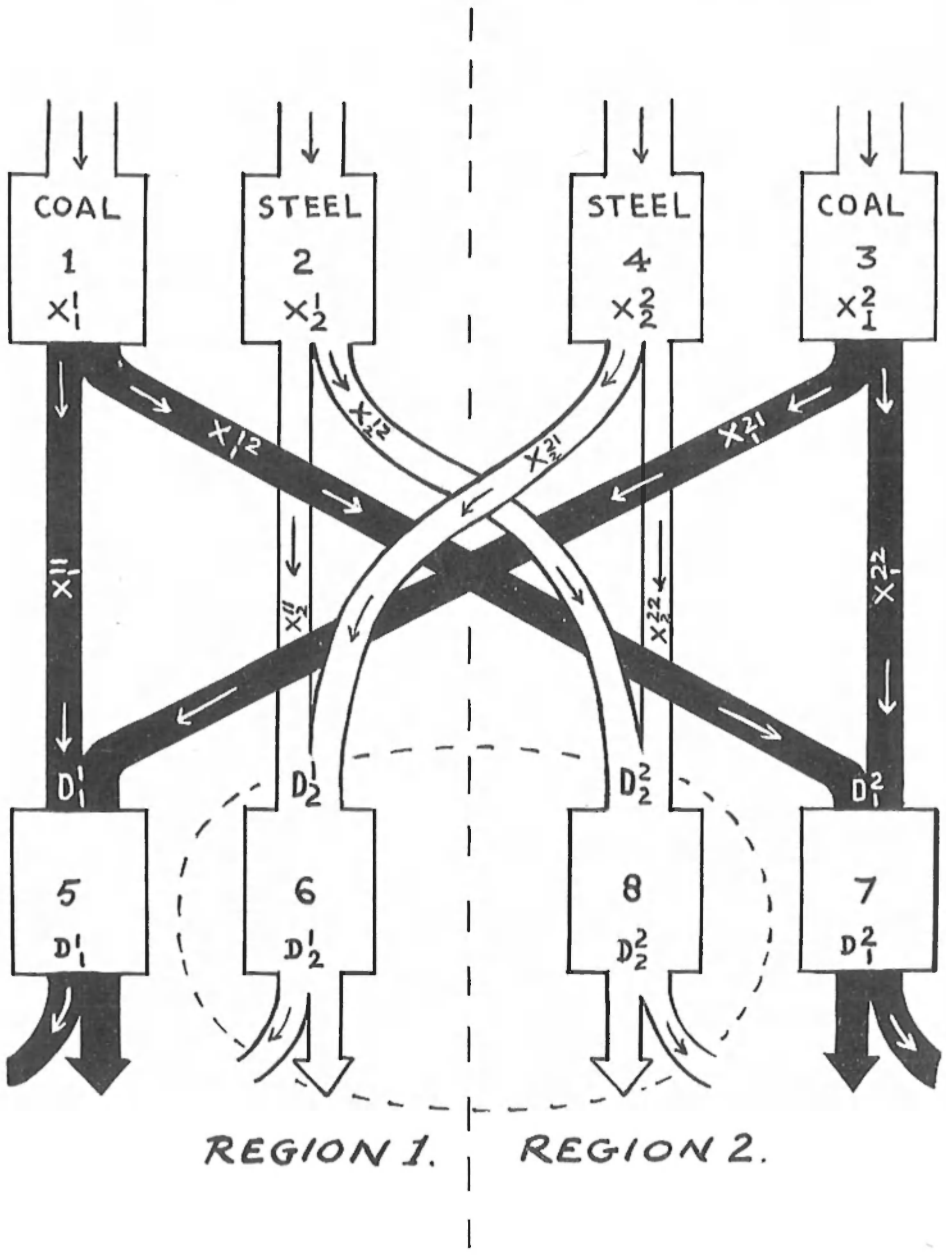
$$D_1^1 = X_1^{11} + X_1^{21}$$

$$D_1^2 = X_1^{12} + X_1^{22}$$
(2.8)
$$D_2^1 = X_2^{11} + X_2^{21}$$

$$D_2^2 = X_2^{12} + X_2^{22}$$

These equations can also by verified by diagram 2. The inflows into the demand boxes come either from the production boxes situated within the region or from those outside it. The equation systems (2.7) and (2.8), however, are not enough to specify completely the magnitudes

DIAGRAM 2: The Satisfaction of TRD's in the Moses Model



$$X_1^1 = D_1^1;\ X_2^1 = D_2^1;\ X_3^1 = D_3^1 \tag{3.1}$$
$$X_1^2 = D_1^2;\ X_3^2 = D_2^2;\ X_3^2 = D_3^2$$

(b) *Nationally-balanced industries:* Industries 4 and 5 (coal and steel) in diagram 3 are "nationally-balanced" industries, i.e. their products have a national market instead of a regional one. The production aspect of these industries remains the same as in the case of regionally-balanced industries, i.e. each region has some productive capacity in that industry. Specifically, each such industry is represented by two separate production boxes in each region. But the TRD's for the products of a nationally-balanced industry in two regions are "pooled". Specifically, this means that the TRD's enclosed by the same circle in diagram 3 are added together. The combined TRD's of both regions may be called Total National Demand (TND). This new concept has been introduced since the characteristic assumption of the Leontief model is in terms of TND's and not in terms of the TRD's. We may indicate the total volume of the two TND's by D_4 and D_5. Thus:

$$D_4 = D_4^1 + D_4^2 \tag{3.2}$$
$$D_5 = D_5^1 + D_5^2$$

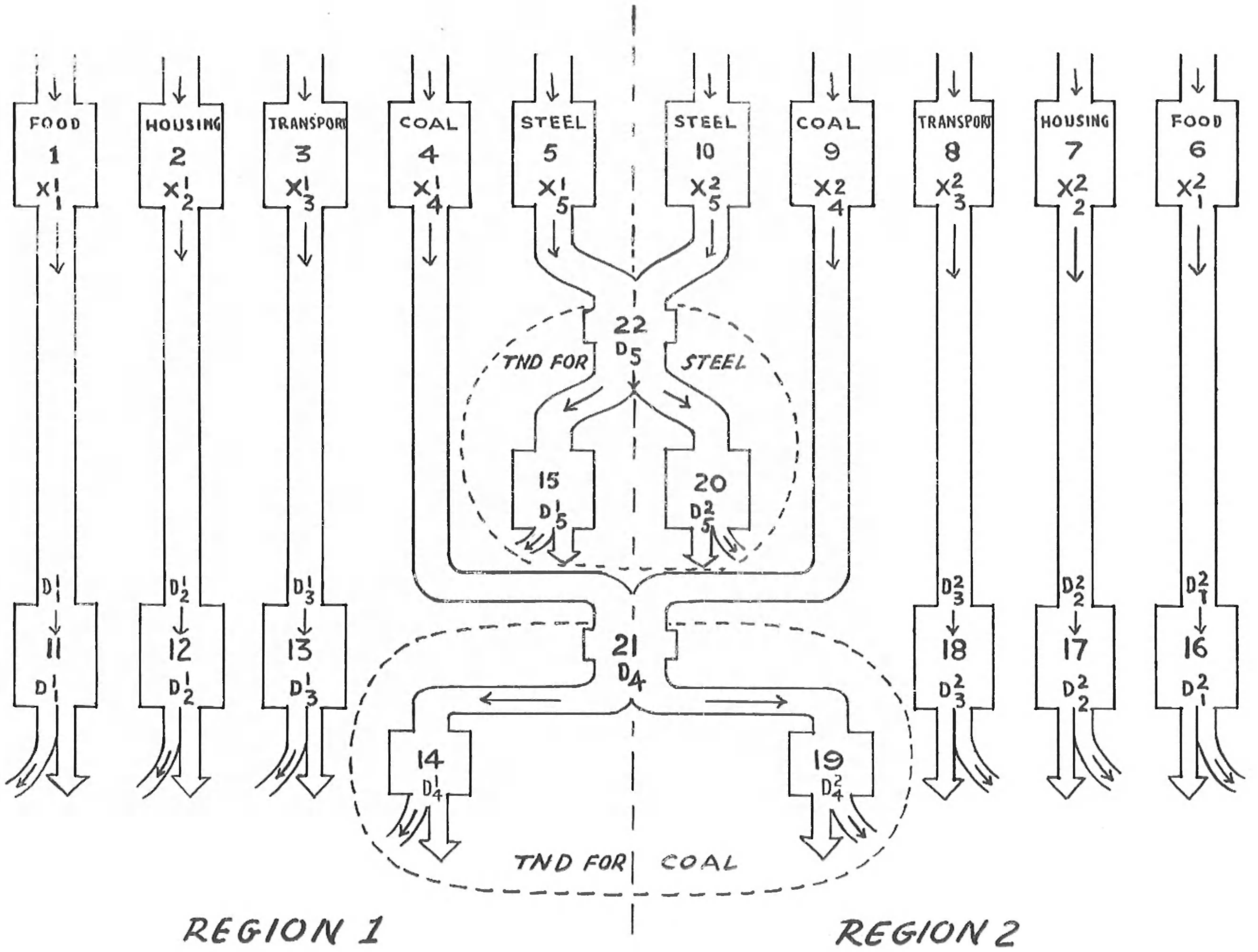
Since TND is simply the sum of all the regional TRD's and since we have discussed the derivation of regional TRD's in the previous section, the derivation of TND does not create any special problem. We shall, therefore, concentrate our attention on the way in which TND is satisfied.

First of all, TND is met by the combined total outputs of the supplying industries in both regions. In other words,

$$D_4 = X_4^1 + X_4^2 \tag{3.3}$$
$$D_5 = X_5^1 + X_5^2$$

The characteristic assumption of the Leontief model in regard to a nationally-balanced industry is the specification of the way in which the two regions shall contribute to satisfy the TND for the product of such an industry. The basic assumption is that *each region's productive contribution to TND will always be a fixed proportion of TND*. If we denote the proportionality constants thus involved, called "regional coefficients", as r_j^i, where r_j^i denotes the relative production contribution of the i'th region towards the TND for the j'th commodity, we have:

DIAGRAM 3: The Satisfaction of TRD's in the Leontief Model



$$X_4^1 = r_4^1 D_4; \; X_4^2 = r_4^2 D_4$$
(3.4)
$$X_5^1 = r_5^1 D_5; \; X_5^2 = r_5^2 D_5$$

Expressed as percentages, the coefficients r_j^i show the percentage-wise split of total national production (= TND) between different regions. It is obvious that the sum of the regional coefficients for a commodity is equal to one. In other words,

$$r_4^1 + r_4^2 = 1$$
(3.5)
$$r_5^1 + r_5^2 = 1$$

In the above, we have described the structural and behaviouristic assumptions characteristic of the Leontief model. We shall, however, postpone the solution of the system until after consideration of the general linear model which gives us a uniform method of solving all linear models considered here.

4. A General Linear Model

In this section we shall investigate the problem relating to the solution of all the inter-regional input-output models that are presented in this paper. We shall attempt to formulate a set of generalised principles to help us with both systematic exposition and solution.

Since all models considered in this paper are so-called "linear models"[1], i.e. models involving a set of linear equations, we shall first formulate and then solve an abstract general linear model with the aid of a pipe diagram. As all the inter-regional models that we shall consider are special cases of the abstract general linear model, the method of solution developed for the general model can then be applied to solve each of the inter-regional models.

A linear model can be presented graphically by means of a pipe-diagram. In diagram 4 we show the pipe-diagram of a three-sector economy. Each sector is connected with itself and with the other two sectors by means of a set of three pipes. Following the convention adopted for our previous diagrams, the outflows are shown to be emanating from the bottom of each production block and the inflows are received at the top. The total outflow from each sector can be sent either to other sectors or viewed as autonomous outflows, represented

(1) Robert Solow, ("On the Structure of Linear Models," Econometrica, Vol. 20, 1952), has shown that input-output models are just a special case of general linear models. Models of international trade as developed, for instance, by Metzler and of the income multiplier, as developed by Goodwin and Chipman, are also essentially linear models.

by C_1, C_2, C_3. The autonomous outflows are those which do not appear as inflows into other sectors. Thus the main component parts of the linear model outlined above are:

i) The total outflow from each sector X_1, X_2, X_3

ii) The allocation of total outflows from each sector to:
a) all other sectors, including itself, x_{11}, x_{12}, x_{13}, x_{21}, x_{22}, x_{23}, x_{31}, x_{32}, and x_{33}

b) autonomous sectors (C_1, C_2, C_3)

For the linear model shown in our diagram the following equations showing the total outflows of the three sectors can be written:

$$
\begin{aligned}
X_1 &= x_{11} + x_{12} + x_{13} + C_1 \\
X_2 &= x_{21} + x_{22} + x_{23} + C_2 \qquad (4.1) \\
X_3 &= x_{31} + x_{32} + x_{33} + C_3
\end{aligned}
$$

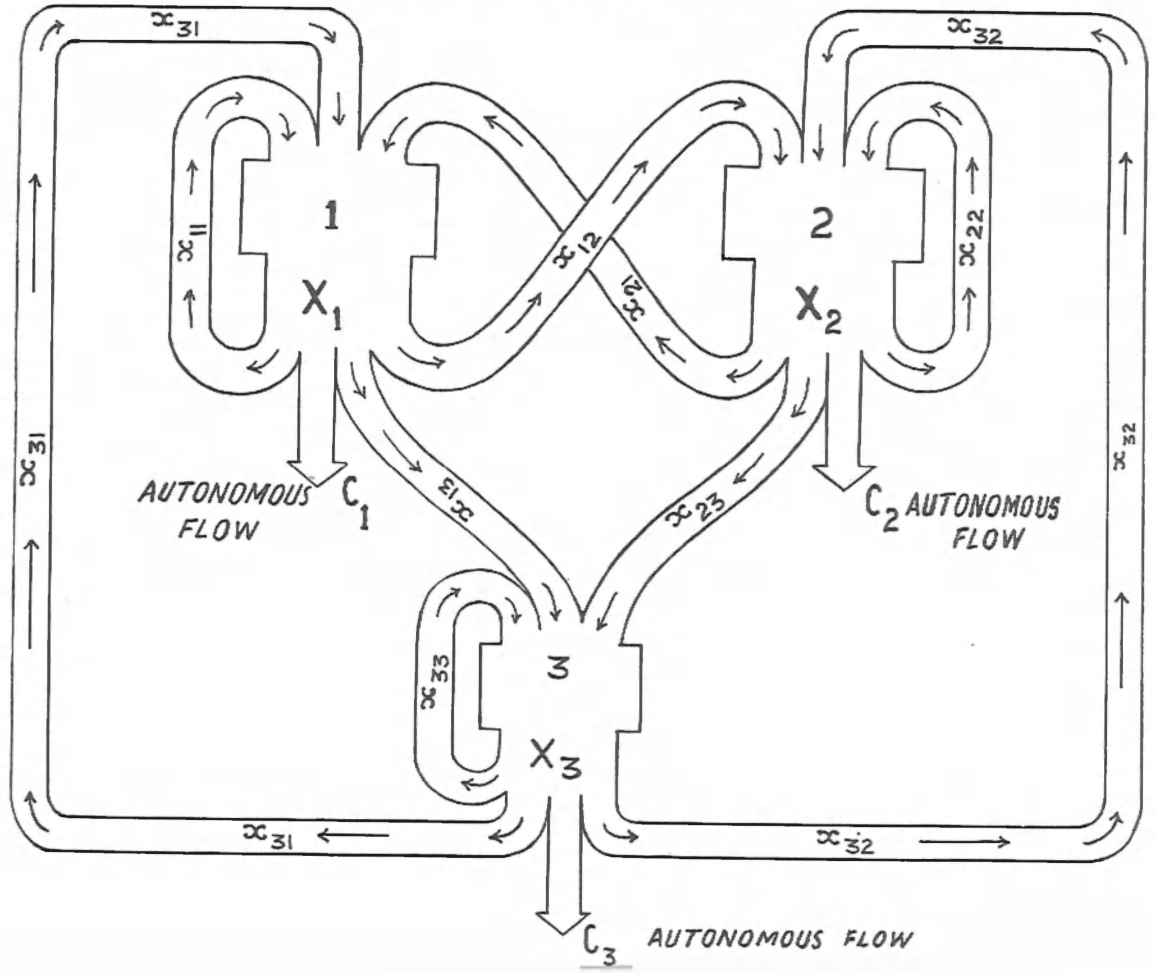
These equations express the accounting relations of the system and are conveniently summarised in a two-way table called the flow table.

Table 4.1 Flow Table

Inter-sectoral Flows			Autonomous Flows	Total Outflows
x_{11}	x_{12}	x_{13}	C_1	X_1
x_{21}	x_{22}	x_{23}	C_2	X_2
x_{31}	x_{32}	x_{33}	C_3	X_3

The total outflow from each sector is shown on the right-hand margin of the table. Its allocation as inter-sectoral flow and autonomous flow is shown in the row entries. For instance, the total outflow from the second sector is shown on the right-hand margin of the second row and its allocation to various sectors in the second row of the table. Each of the first three columns shows the inflows into the three sectors.

So far we have not assumed any behaviouristic relationships between the inflows and outflows of a sector. A characteristic assumption of all linear models is an exact proportionality between the inflows and outflows of a sector. In other words, DIAGRAM 4: A General Linear Model



This is a system of three equations in three unknowns (X_1, X_2, X_3). The technical coefficients, a_{ij}, are assumed to be given as structural parameters of the system. The total outputs (X_1, X_2, X_3) can be solved by the above system for a given set of exogenous variables (C_1, C_2, C_3).

Summary: We have seen that a general linear model is completely specified by two sets of relations:

(*a*) Accounting relations: These are expressed in a Flow Table (Table 4.1)

(*b*) Behaviouristic relations: These are expressed in a Co-efficients Table (Table 4.2)

With the information contained in the two tables (4.1 and 4.2), we can solve equation (4.4) and determine all the magnitudes of the system completely.

Since all the inter-regional models that we shall consider in this paper can be transformed, ultimately, into the form of (4.4), the understanding of the basic structure of these models requires no more mathematics than is necessary for the derivation of the two sets of tables referred to above. Hence, in the following, we shall only need to specify the flow table and the co-efficients matrix for each of the models. If the reader has grasped the solution of the general linear model outlined above he should have no difficulty in understanding the mathematical details involved in individual models.

It is, perhaps, worth repeating that a pipe diagram is merely a diagrammatic interpretation of a flow table. Thus, for the sake of expositional convenience, we have adopted the convention of presenting the pipe diagram first and then deriving a flow table from it.

5. Solution of the Leontief System

In the following we shall proceed to solve the Leontief model presented in Section 3.1 according to the general principles outlined above. Specifically, we shall attempt to identify the structural and behaviouristic assumptions of the model. This can be done most clearly by writing out: (*a*) the flow table and (*b*) the coefficients table of the system.

5.1. *The Flow Table.* The flow table (Table 5.1) merely expresses in tabular form the information given graphically in diagram 3. There are 22 boxes in diagram 3, numbered from 1 to 22. Each numbered row and the corresponding column in Table 5.1 represents the box (or a sector) of diagram 3 bearing the same number. There are 22 rows and 23 columns in the table. The last column, i.e. the 23rd, represents the autonomous outflow from each TRD box. In our case these autonomous outflows are final demands $Y_1^1, Y_2^1, ..., Y_5^1, Y_1^2, ..., Y_5^2$ which appear in rows 11 to 20 of the last column.

The total outflows of each of the 22 sectors are shown on the right-hand margin of the table. As can be seen from both diagram 3 and table 5.1, the total outflows from sectors 1 to 10 are total outputs of the five industries in each region, those from sectors 11 to 20 are TRDs of the five industries in each region and those from sectors 21 and 22 are the TND's for the products of the two nationally-balanced industries.

The allocation of the total outflows from each sector are shown in the corresponding row. For example, the total outflow of sector 11, D_1^1, consisting of x_{11}^1, x_{12}^1, x_{13}^1, x_{14}^1, x_{15}^1, and Y_1^1, is allocated in row 11 of the table. Its total outflow is seen to be allocated to the first five sectors as intermediary factors of production and to the 23rd sector as final demand.

The flow table is thus a complete representation of all the inter-sectoral and autonomous flows of the system. It gives us a set of accounting relationships for every sector and explains very clearly the origin and destination of each individual flow. The flow table also represents, of course, the first step in transforming the Leontief model into the pattern of a general linear model.

5.2. *The Co-efficients Table:* The behaviouristic assumptions in terms of the relationships between inflows and total outflows is expressed by the co-efficients table or matrix in table 5.2. This matrix corresponds to the square table constituted by all the first 22 rows and columns of the flow table 5.1. As we have already seen when discussing the general linear model the co-efficients matrix is a square matrix containing one column less than the flow table.

It is to be noted that a large number of elements in the flow table are zeros. This, by definition, means that there is no transaction between the sectors involved. It follows that whenever a zero appears in flow table 5.1 the corresponding entry in the co-efficients matrix 5.2 must also be zero.

We shall now consider the significance of the non-zero elements in the co-efficients matrix. As we know, any element in the matrix expresses the amount of inflow from a particular sector required to produce a unit of the outflow of another sector. Thus each column in the co-efficients matrix shows the proportions of inflows from all other sectors received by the sector represented by that column.

It is to be observed that each of columns 11 to 20 contains only one non-zero element, which is unity. This is so because the total outflow from the sector represented by each column is made up of one single inflow supplied by the sector represented by the row in which the unit element falls. For example, we see that there is a unit element in column 17 and row 7 of Table 5.2. This is so because the total outflow of the 17th sector, D_2^2, is made up of a single inflow from sector 7, X_2^1 (i.e. $X_2^2 = D_2^1$), as can be easily seen in the diagram.[1]

Apart from the zero and unit co-efficients occurring in Table 5.2, there are two sets of *significant co-efficients* in the table. The first set which represent production co-efficients, lie in columns 1 to 10 of the co-efficients matrix. The second set which represent the regional co-efficients, lie in the 21st and 22nd columns. We shall discuss these two sets of co-efficients separately.

Production Co-efficients: The production co-efficients for the two regions are neatly separated in our table. The production co-efficients for region 1 are contained in columns 1 to 5 and the production co-efficients for region 2 are contained in columns 6 to 10. The production co-efficients in any column express the inputs required from other sectors for the production of a unit of output of the sector represented by the column. These inflow-outflow co-efficients are based on production considerations or on engineering necessity. Mathematically, as in the case of the general linear model, these co-efficients can be seen as expressing the following general relation:

$$x_{ij}^{k} = a_{ij}^{k} X_j^k \qquad \text{(where i, j = 1, 2, 3, 4, 5 and k = 1, 2)}$$

It is plausible to assume that for the production of the same commodity two regions may adopt different technologies of production. In terms of the co-efficients matrix this means that the corresponding production co-efficients for the two regions may well be different. While the original Leontief formulation of the model precludes such a possibility, (i.e. the Leontief model assumes that the production co-efficient matrices of the two regions are identical), we have made no such restrictive assumption in our presentation.

Regional Co-efficients: The co-efficients which occur in columns 21 and 22 express the proportionate production contribution of each region in satisfying the TND for the products of nationally-balanced industries 4 and 5 (coal and steel). These co-efficients express the characteristic assumption of the Leontief model with regard to a

(1) The existence of columns with all except one of their elements equal to zero considerably facilitates the computational task. Computational aspects of the problem will not, however, be discussed in this paper.

TABLE 5.2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r_4^1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r_5^1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r_4^2	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r_5^2
11	a_{11}^1	a_{12}^1	a_{13}^1	a_{14}^1	a_{15}^1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	a_{21}^1	a_{22}^1	a_{23}^1	a_{24}^1	a_{25}^1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	a_{31}^1	a_{32}^1	a_{33}^1	a_{34}^1	a_{35}^1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	a_{41}^1	a_{42}^1	a_{43}^1	a_{44}^1	a_{45}^1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	a_{51}^1	a_{52}^1	a_{53}^1	a_{54}^1	a_{55}^1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	a_{11}^2	a_{12}^2	a_{13}^2	a_{14}^2	a_{15}^2	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	a_{21}^2	a_{22}^2	a_{23}^2	a_{24}^2	a_{25}^2	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	a_{31}^2	a_{32}^2	a_{33}^2	a_{34}^2	a_{35}^2	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	a_{41}^2	a_{42}^2	a_{43}^2	a_{44}^2	a_{45}^2	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	a_{51}^2	a_{52}^2	a_{53}^2	a_{54}^2	a_{55}^2	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

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nationally-balanced industry, i.e. the production contribution of each region is a fixed percentage of the TND for the products of such an industry. The validity of the inflow-outflow relations expressed by these co-efficients has been discussed in Section 7. Mathematically, as in the case of the general linear model, these co-efficients express the following general relation:

$$X_j^k = r_j^k D_j \quad \begin{pmatrix}\text{where } j = 4, 5 \\ \text{and } \quad k = 1, 2\end{pmatrix}$$

It is obvious that all the regional co-efficients of the same industry, i.e. the co-efficients falling in the same column, should add up to 1 (see equations 3.5).

We have now fully described the flow table and the co-efficients matrix of the Leontief model. The solution of the model reduces to a set of simultaneous linear equations which are similar in nature to (4.4).

6. The Moses Model

We shall now present the inter-regional model of Professor Leon Moses already referred to. For the sake of simplicity we shall assume that there are two regions, 1 and 2, and two industries, steel and coal, in each region. Under these assumptions, diagram 2 which we have discussed earlier will be perfectly adequate to represent the structure of the Moses model. Hence, we shall only describe the translation of this diagram into a flow table and a co-efficients matrix for the Moses model.

The Flow Table: Table 6.1 represents the flow table of the Moses model outlined above and is a direct translation of the corresponding pipe-diagram (diagram 2). The number of rows in the table is eight as there are eight boxes in the diagram. The number of columns is again one more than the number of sectors. The general principles of construction and the interpretation of the flow table is exactly the same as in the case of the general linear model.

The Co-efficients Matrix: Table 6.2 represents the co-efficients matrix of the Moses model. Columns 1 to 4 of the table contain the production co-efficients of the two industries in the two regions. All general remarks made in connection with the co-efficients matrix of the Leontief model are also valid here, and no further explanation is therefore required.

The Trading Co-efficients: Cols. 5 to 8 of table 6.2 contain the trading co-efficients. These, though similar to the regional co-efficients of the Leontief model mathematically, require further elaboration. These co-efficients express the trading pattern of each region in regard to each separate commodity. Each of the last four columns shows the import pattern of a region with respect to a particular commodity. As in the case of the general linear model, a systematic mathematical interpretation can be given to the co-efficients in these columns:

Column 5: $X_1^{11} = t_1^{11} D_1^1$; $X_1^{21} = t_1^{21} D_1^1$ (Commodity 1 in region 1)

Column 6: $X_2^{11} = t_2^{11} D_2^1$; $X_2^{21} = t_2^{21} D_2^1$ (Commodity 2 in region 1)

Column 7: $X_1^{12} = t_1^{12} D_1^2$; $X_1^{22} = t_1^{22} D_1^2$ (Commodity 1 in region 2)

Column 8: $X_2^{12} = t_2^{12} D_2^2$; $X_2^{22} = t_2^{22} D_2^2$ (Commodity 2 in region 2)

Thus the trading co-efficients in a column describe the *import pattern* of a commodity in a region. These co-efficients express the characteristic assumption of the Moses model, i.e. for any given commodity, each region will always import a fixed percentage of its TRD from each regional source of supply. The validity of the relations expressed by these co-efficients will also be discussed in Section 7. Since, for any commodity, the various sources of supply must combine to satisfy the TRD, the following conditions must necessarily be satisfied:

$$t_1^{11} + t_1^{21} = 1$$

$$t_2^{11} + t_2^{21} = 1$$

$$t_1^{21} + t_1^{22} = 1$$

$$t_2^{21} + t_2^{22} = 1$$

The flow table and the co-efficients matrix of the Moses model described here are sufficient to solve the model completely.

7. A Comparison of Assumptions

In this section we shall attempt to compare the essential features of the two models and the assumptions on which they rest.

In sections 5 and 6 we have seen that the two models do not differ in their derivation of the total regional demand for a commodity. To recapitulate, this demand is made up of (*a*) the inter-industrial demands for that commodity which are governed by the production co-efficients of these industries and (*b*) final demands which arise in households, government, exports, and other autonomous sectors.

TABLE 6.1

	1	2	3	4	5	6	7	8	9	
1	0	0	0	0	X_1^{11}	0	X_1^{12}	0	0	X_1^1
2	0	0	0	0	0	X_2^{11}	0	X_2^{12}	0	X_2^1
3	0	0	0	0	X_1^{21}	0	X_1^{22}	0	0	X_1^2
4	0	0	0	0	0	X_2^{21}	0	X_2^{22}	0	X_2^2
5	x_{11}^1	x_{12}^1	0	0	0	0	0	0	Y_1^1	D_1^1
6	x_{21}^1	x_{22}^1	0	0	0	0	0	0	Y_2^1	D_2^1
7	0	0	x_{11}^2	x_{12}^2	0	0	0	0	Y_1^2	D_1^2
8	0	0	x_{21}^2	x_{22}^2	0	0	0	0	Y_2^2	D_2^2

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TABLE 6.2

	1	2	3	4	5	6	7	8
1	0	0	0	0	t_1^{11}	0	t_1^{12}	0
2	0	0	0	0	0	t_2^{11}	0	t_2^{12}
3	0	0	0	0	t_1^{21}	0	t_1^{22}	0
4	0	0	0	0	0	t_2^{21}	0	t_2^{22}
5	a_{11}^1	a_{12}^1	0	0	0	0	0	0
6	a_{21}^1	a_{22}^1	0	0	0	0	0	0
7	0	0	a_{11}^2	a_{12}^2	0	0	0	0
8	0	0	a_{21}^2	a_{22}^2	0	0	0	0

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The two models differ in their assumptions about the way the TRD for a commodity is satisfied from the outputs of different regions. In this section we shall contrast the two models with respect to this main difference.

The difference in the assumptions regarding trading patterns has two aspects: (1) the formal structural aspect and (2) the extra-model aspect. The first aspect deals with the structural and functional relationships assumed in the two models. The second aspect is concerned with the justification of the assumptions on economic or other extra-model considerations.

7.1. *The Formal Structural Aspect:* This aspect can best be understood by viewing the Leontief model as a special case of the Moses model. It is to be noted that in our exposition of the Moses model we did not make any special assumptions about the various industries, i.e. we did not assume, unlike the Leontief case, that some industries were regionally-balanced and others nationally-balanced. In fact, the Moses model can embrace both kinds of industries if certain special assumptions are made.

Let us now suppose that in the hypothetical model described in diagram 2, the first industry, i.e. coal, has the characteristics of a regionally-balanced industry in the Leontief sense, and the other industry, i.e. steel, is a nationally-balanced industry. By making the following special assumptions with regard to trade coefficients in the Moses model it is possible to bring out these characteristics:

(1) *For the regionally-balanced industry coal* the pipes carrying coal from one region to another (shown in diagram 2) must have zero flows. This, indeed, is the formal characteristic of a regionally-balanced industry. This characteristic can be established if we make the special assumption that all the external trading co-efficients of the coal industry in both regions are zero. (In other words, their internal trading co-efficients are unity).

(2) *For the nationally-balanced industry steel* we have to make a special assumption about the trading co-efficients of this industry in each region. The assumption is that both regions have an indentical set of trading co-efficients for this industry. For instance, if region 1 imports 40 per cent of its TRD for steel from region 1 (itself) and 60 per cent from region 2, and region 2 also imports the *same* percentages of its TRD's from the two regions, then the steel industry is a nationally-balanced industry in the Leontief sense. It is obvious that if the two regions have *identical* trading patterns, with respect to a certain commodity any change in regional total demand of either region will have the same effect on regional production as a similar

change in aggregate national demand for that industry's output[1].

7.2. *The Extra-Model Aspect*

In our discussion of the formal structural aspects of the difference between the Leontief and Moses models we have seen that the former is, in fact, a special case of the latter. We shall, therefore, first try to seek a possible justification of the assumption of the Moses model on extra-model grounds and then see if the further restrictive assumptians of the Leontief model can also be justified on the same grounds.

The assumption of the Moses model, namely the stability of the inter-regional trading co-efficients, can be justified in the short run, according to Moses, only if certain conditions are satisfied on the supply side i.e. in regard to the productive capacities of different regions. These are: (*a*) there is a pool of unemployed labour in both regions; (*b*) every industry in each region has excess productive capacity; and (*c*) there is excess capacity in the transportation network between the two regions.

Given these flexibilities on the supply side the assumption of trade co-efficient stability can be justified by (*a*) the existence of institutional factors, such as contractual agreements, the influence of custom, habit and inertia on the part of consumers, producers and distributors and (*b*) the assumption that the spatial composition of total demand within a region remains unchanged.[2]

None of these demand considerations can, however, help to maintain the much more restrictive assumptions of the Leontief model. For neither institutional factors nor the stability in the spatial composition of total regional demand can ensure that all the regions will have identical trading co-efficients in the case of certain industries (called nationally-balanced industries by Leontief). Leontief himself calls the basic assumption of his model "incorrect"[3]. Nevertheless,

(1) In diagram 2 a circle is drawn enclosing the demand blocks of the steel industry in the two regions (Secto s 6 and 8) indicating that they are to be aggregated in the ordinary sense. (With the aggregation of demand blocks the pipes flowing from the bottom of the two demand blocks will then create a single 'national pool' as in the case of the nationally-balanced industries of the Leontief model shown in diagram 3). As identical trading co-efficients are assumed for both regions this will not produce any error of aggregation. It is in this sense that the Leontief model is said to be a special case of the Moses model. It can be seen that the aggregation of TRD's of a nationally-balanced industry in diagram 3 has the same significance as the one described here.

(2) Every region buys a fixed proportion of a commodity from another region because of the proximity of the different places within the region to the sources of production within and outside the region. If the intra-regional composition of this demand changes the stability in the trade co-efficients will not be maintained.

(3) W. Leontief, "Studies", op. cit., p. 29.

this assumption can be held to be tenable in at least two special cases: (*a*) in industries where the elasticity of supply of a commodity is the same, i.e. uniform expansion and contraction, in all regions (this can be assumed to be the case, for instance, in agriculture where the elasticity of supply is notoriously low in both regions); (*b*) in cases where it may be the government's deliberate policy that production should expand and contract proportionately in every region. This may be done in order to promote social and economic equity or to stimulate the growth of certain industries in the region where factor endowments are less favourable to their development. This applies in the case of Pakistan where the Government is avowedly following a policy of "regional balance" in the country.

8. A General Model

We have shown in the above section that a regionally-balanced industry (in the Leontief sense) is a special case of an industry of the Moses variety. Specifically, a regionally-balanced industry is obtained by assuming that a particular set of trading co-efficients, i.e. the external trading co-efficients, vanish. However, if we make assumptions about the vanishing of trading co-efficients in certain *other* ways we may be able to distinguish other types of industries with characteristic features.

We shall investigate this problem systematically by identifying all possible cases (i.e. all cases in which none, some, or all trading co-efficients are zero). For the sake of simplicity, we shall confine our investigation to two trading regions only. Then for a particular industry, i, there will be four trading co-efficients, viz. t_i^{11}, t_i^{21} (the import or trading co-efficients of region 1) and t_i^{21} t_i^{22} (the import or trading co-efficients of region 2). A simple combinatorial formula tells us that there are exactly 16 cases—representing particular ways in which none, some, or all trading co-efficients vanish[1].

Due to the symmetry with respect to either region the 16 cases have been classified into 10 groups. We shall assign a name to each of the major groups and discuss, with the aid of diagrams illustrating each individual case (Diagram 5), the economic significance of each major group, with special reference to its applicability to the case of East and West Pakistan. Notice that the vanishing of a trading co-efficient implies the vanishing of the corresponding inter-regional flow, which is shown in diagram 5.

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(1) If there is a set of four objects (a, b, c, d), there are exactly $2^4 = 16$ distinct subsets—viz. (0), (a), (b), (c), (d), (ab), (ac), (ad), (bc), (bd), (cd), (abc), (abd), (bcd), (acd) and (abcd). In general, if there is a set of n objects, there are exactly 2^n distinct subsets.

Group I: **Non-existent Industry**

Case 1: Assume $t_i^{11} = t_i^{12} = t_i^{21} = t_i^{22} = 0$

This is a trivial case when there is neither the production of nor the demand for commodities produced by such an industry. In other words, such an industry has no existence in the economy.

Group II: **Weak Regionally-Balanced Industry**

Case 2: Assume $t_i^{11} = 1; \quad t_i^{12} = t_i^{21} = t_i^{22} = 0$

Case 3: Assume $t_i^{22} = 1; \quad t_i^{11} = t_i^{12} = t_i^{21} = 0$

This is the case of a commodity which is produced and consumed solely in one region. The other region neither produces nor consumes such a commodity, i.e. the industry does not exist there. It can easily be seen that an industry producing such a commodity is a special case of the regionally-balanced industry of the Leontief type.

A commodity of this sort can have a common occurence if the two regions differ widely in factor endowments and consumption patterns. The absence of production of such a commodity in one region can easily be explained in terms of a lack of availability of resources, climatic and geographical factors. A commodity of this sort can either be an industrial raw material (raw jute in the case of East Pakistan and raw wool in the case of West Pakistan) or a consumer good (bananas, pineapple and other tropical fruits in East and apples, grapes and other temperate fruits in West Pakistan).

The reason why such a commodity is also not consumed in the region which does not produce it is two-fold. Firstly, if the commodity is an industrial raw material or a semi-finished product, this may be due to the lack of complementary processing industries. Secondly, if the commodity is a consumer good then this may be due to one or more of the following reasons: (*a*) lack of consumer preference for such a commodity, (*b*) perishability and (*c*) prohibitive transport costs.

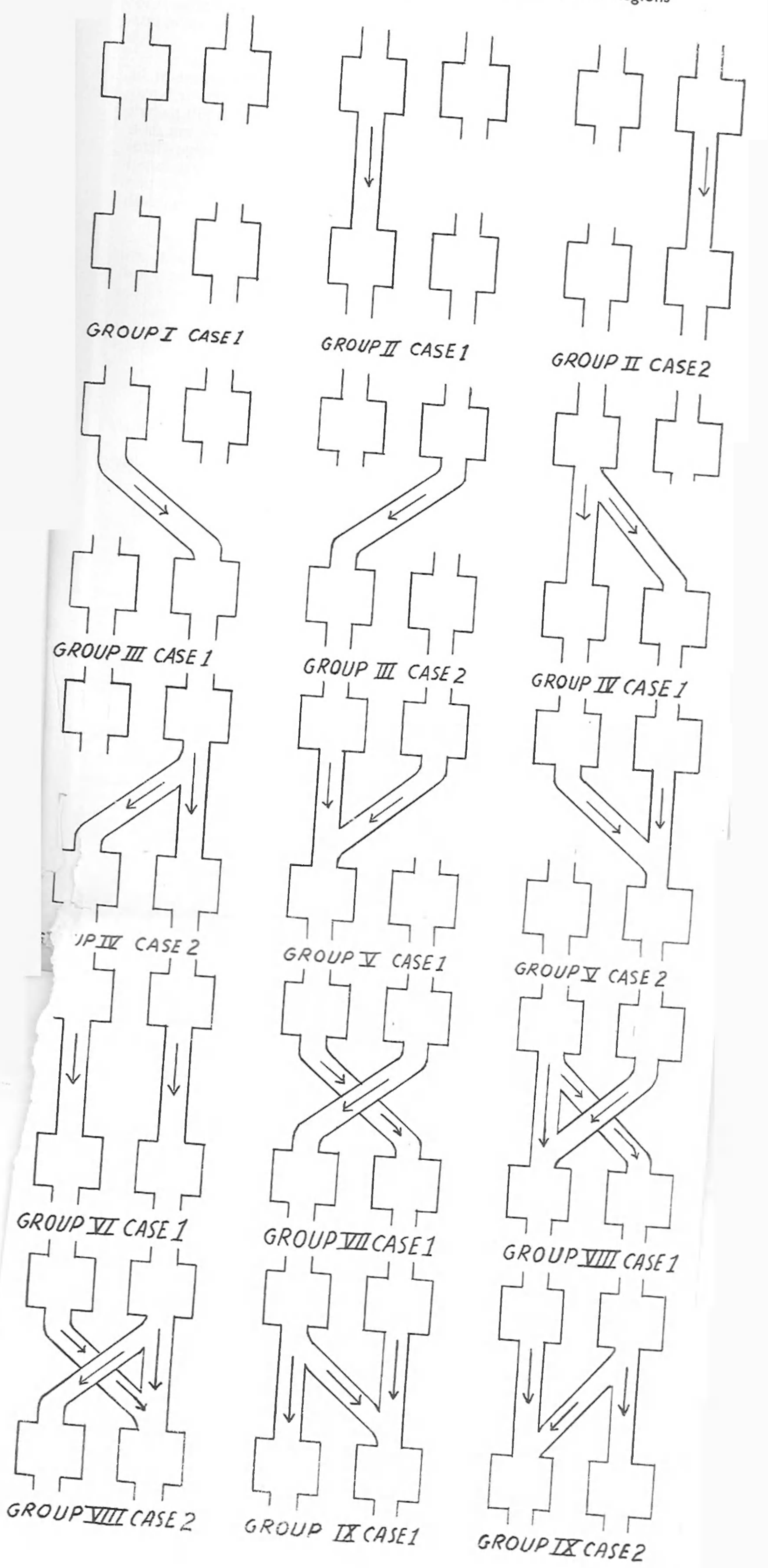
Group III. **"Colonial" Industry**

Case 4: Assume $t_i^{12} = 1, \; t_i^{11} = t_i^{21} = t_i^{22} = 0$

Case 5: Assume $t^{21} = 1, \; t_i^{11} = t_i^{12} = t_i^{22} = 0$

This the case of a commodity which is produced solely in one region and consumed solely in the other. As is obvious, such a commodity is unlikely to be a consumer good. It will either be a raw material

DIAGRAM 5: Possible Trading Patterns Between Two Regions



or a semi-finished product, e.g. crude oil or mineral ore, exported to the other region for processing.

A trading pattern of this kind has a familiar analogy in the history of international trade. This was the pattern which the so-called "imperialist" countries of the West imposed on their colonies in the East during the nineteenth century—a pattern which all developing economies are trying to do away with rapidly. Such a trading pattern in the inter-regional trade of underdeveloped countries is also a legacy of imperialism, due to the uneven pace of economic development in different regions, i.e. the proverbial "North" and "South" of the less-developed economy.

Pakistan is trying hard to reduce inter-regional economic inequalities. But the goal has not yet been fully achieved and it is possible that a trading pattern of this kind may exist in the case of some commodities, although high transport costs rule out such a possibility in most cases. Even if such a pattern does exist in some industries, it is unlikely to be maintained for very long. In other words, the trading co-efficients of such industries are likely to be unstable.

Group IV: **Regionally-Monopolised Industry**

Case 6: Assume $t_i^{11} \neq 0,\ t_i^{12} \neq 0,\ t_i^{21} = t_i^{22} = 0$

Case 7: Assume $t_i^{21} \neq 0,\ t_i^{22} \neq 0,\ t_i^{11} = t_i^{12} = 0$

This is the typical case in which one region specializes in the production of a certain commodity, to the complete exclusion of the other. Regional specialization is usually due to factor endowment differentials and its theoretical justification is familiar to all students of international trade. A typical example of a regionally-monopolised industry for the case of East Pakistan is jute manufactures and for the case of West Pakistan woollen textiles.

Group V: **Regional Consumption Industry**

Case 8: Assume $t_i^{11} \neq 0,\ t_i^{21} \neq 0,\ t_i^{12} = t_i^{22} = 0$

Case 9: Assume $t_i^{12} \neq 0,\ t_i^{22} \neq 0,\ t_i^{11} = t_i^{12} = 0$

This is the case of a commodity which though produced in both regions is consumed exclusively in one region. This also is unlikely to be a consumer good and is most probably an industrial raw material or a semi-finished product. The consumption aspect of such a commodity is the same as of that produced by a "colonial" industry. One region is likely to be relatively deficient in the factor endowments required for complementary raw material processing industries. In addition, there may be another important reason for the existence of a trading pattern of this kind. The processing industry which uses the products of a "regional consumption industry" may involve overhead costs which the regions may not be able to afford individually. In other words there may exist factor indivisibilities in the creation of the complementary processing industries. For instance, the country may be able to afford only one oil refinery (or steel mill) situated in a particular region and the crude oil (or iron ore) production of the other region may have to be shipped entirely to this region for processing.

Group VI: **Strong Regionally-balanced Industry**

Case 10*:* Assume $t_i^{11} \neq 0$, $t_i^{22} \neq 0$ and $t_i^{12} = t_i^{21} = 0$

This is the by now familiar case of the regionally-balanced industry of the Leontief model. In the case of East and West Pakistan a large number of industries are likely to be regionally-balanced due to the transport cost limitation.

Group VII: **Barter Industry**

Case 11*:* Assume $t_i^{12} \neq 0$, $t_i^{21} \neq 0$, $t_i^{11} = t_i^{22} = 0$

This is a very unlikely case. Both regions produce a commodity but each consumes exclusively the output of the other. Even if it is assumed that such a pattern exists at a certain time it is obvious that it cannot have permanence. Both regions will try to minimise the transportation costs involved in inter-regional trade and a region will import from the other region only if its TRD is greater than its regional production of that commodity and only to the extent of this difference. In other words this trading pattern will soon be converted into that of the "surplus industry" described below. The existence of this type of industry can safely be ruled out for the case of East and West Pakistan.

Group VIII: **Product-Differentiated Industry**

Case 12*:* Assume $t_i^{11} \neq 0$, $t_i^{12} \neq 0$, $t_i^{21} \neq 0$, $t_i^{22} = 0$

Case 13*:* Assume $t_i^{12} \neq 0$, $t_i^{21} \neq 0$, $t_i^{22} \neq 0$, $t_i^{11} = 0$

This is the case of a commodity which is produced in both regions but the output of each is completely consumed by the other. The existence of an industry of this type can be justified only on grounds of product differentiation. For example, one region may be producing high grade textiles only which it exports to the other region, while the other region supplies it with coarse cloth. The existence of such industries in either region of Pakistan appears highly unlikely.

Group IX: **Surplus Industry**

Case 14: Assume $t_i^{11} \neq 0, \; t_i^{21} \neq 0, \; t_i^{22} \neq 0, \; t_i^{12} = 0$

Case 15: Assume $t_i^{11} \neq 0, \; t_i^{12} \neq 0, \; t_i^{22} \neq 0, \; t_i^{21} = 0$

This is the case of a commodity in which one region is not self-sufficient and imports its deficit from the other region, while the other region can meet all its TRD by internal sources and is able to export its surplus to the first region. This is by far the most common pattern of inter-regional trade. Capacity limitations in either region are likely to exist in some industries. Cotton textile in the case of West Pakistan and matches in the case of East Pakistan can be cited as examples.

Group X: **The Moses Industry**

Case 16: Assume $t_i^{11} \neq 0, \; t_i^{12} \neq 0, \; t_i^{21} \neq 0, \; t_i^{22} \neq 0$

This is the trading pattern of a typical Moses industry and is illustrated by diagram 2. The reasons for assuming this pattern have been fully discussed in Section 7.

In addition to the 16 cases enumerated above, the nationally-balanced industry of the Leontief model is also a special case of the Moses model as shown in 7.2 above. We have thus seen that the Moses model can embrace a large variety of industries whose trading patterns are known in advance. The practical implementation of the Moses model will, therefore, consist primarily of categorising industries according to their assumed trading patterns.

9.1 The Applicability of the Model to Pakistan

The logic of dividing Pakistan's economy into two regions—East and West—is, perhaps, stronger than in the case of any other country. For in no other country are the geographical boundaries so nearly co-terminous with the economic boundaries. No two regions of a country, perhaps, differ as widely in production practices and consumption patterns as East and West Pakistan. There are, of course, many such differences within each region and the model can gain considerably in analytical sharpness if each region were divided into smaller sub-regions. A multi-region model is one of the directions in which the present study can be extended.

The application of any analytical model is, of course, directly dependent on the availability of basic data, if it is to have any empirical content. As far as is known no attempt has so far been made to construct an input-output table, regional or national, for Pakistan. The Planning Commission has stated that the technique is "not helpful in the present stage of statistical information in the country".[1] Yet, as many as three (perhaps more) input-output tables have been constructed in India, which shared almost the same statistical heritage as Pakistan at the time of Partition. The bulk of statistics, especially in agriculture, industry, mining and in relation to households and external trade are of roughly the same quality in both countries. Some of the information made available in the reports of the National Income Committee and the National Sample Survey of India may also be used, in the absence of something better, in the case of Pakistan.

Recently some new statistical data have become available which should lessen the skepticism about the feasibility of the proposed undertaking. The Ministry of Labour has published the results of a Survey of Manpower for the year 1955 in both regions bringing up-to-date the 1951 Census information on the occupational distribution and strength of the working force. A Census of Manufactures is now available in full detail for the calendar years 1954 and 1957. The Census gives separate figures for East and West Pakistan for each industry and its scope is somewhat greater than that of the Indian Census of Manufacturing Industries. A survey of large and small-scale industries in Karachi has recently been undertaken at the Institute of Development Economics and its results can be used. A Census of Agriculture is presently underway and may prove of great help in giving a firm footing to estimates of the cost structure in agriculture. Regarding household expenditure two surveys have been conducted into the family budgets of industrial workers and middle class commercial and government employees in 1954-55 for the whole country. The first and second rounds of the National Sample Survey have collected some information on the expenditure of rural households.

A model of this nature can hope to give satisfactory results as an analytical tool only in so far as it is based on reliable data. The difficulties in regard to the availability of reliable data are immense and cannot be emphasised too strongly. However, perfection in economic statistics can never be achieved and the economist and the statistician must sometimes rely as heavily on their ingenuity and judgment as on the available data. An experiment of this kind, apart from its significant intrinsic value as an analytical tool, can also serve the purpose of indicating the direction for future research efforts and the improvements which can be made in the basic data.

(1) The National Planning Board, Government of Pakistan, "First Five Year Plan", December, 1957, p. 79.

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