THE UNIVERSITY OF MANITOBA

AN OUTLOOK MODEL OF CANADIAN AGRICULTURAL INPUTS AND OUTPUTS: AN INPUT-OUTPUT APPROACH

by

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ABSTRACT

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Major Advisor: Dr. M. H. Yeh

The need for economic forecasting may not be over-emphasized. Accurate forecasts could be used in a number of economic activities - productions, consumption, investment and employment. Almost all forecasts are structural forecasts i.e. forecasts based upon the assumptions of the economic structure of the past. A significant change in the structure between the base and the future period will, therefore, distort a set of forecasts. For this reason, structural change is also of interest to economists.

With emphasis on agriculture and related sectors of the Canadian economy, the objectives of this study were to: (a) forecast gross output vectors for 35 industries; (b) examine changes in input structure of industries between 1961 and 1966, and 1966 and 1971; (c) examine structural change in the economy between 1961-1966 and 1966-1971 periods.

A rectangular input-output model was used for the analysis. The model is based upon a commodity-industry system where the number of commodities exceeds the number of industries. There were three compatible tables for the Canadian economy for the years 1961, 1966 and 1971.

The following were the main findings of the study:

1. Commodity multipliers showing the necessitated change in gross output due to a one dollar rise in final demand were calculated for the year 1971. The multipliers for the unprocessed agricultural commodities were, in general, lower than the various manufacturing sector commodities which, in turn, were lower than the processed agricultural commodities.

2. Gross output vectors were forecasted for the year 1980. The average yearly growth rates between 1961-1971 period were comparable to 1971-1980 period for similar groups of industries.

3. The change in input structure among industries between the two five-year periods: 1961-1966 and 1966-1971 were fairly similar indicating that 'new' inputs have not been introduced or the accounting practice for keeping record of inputs has not changed. As for changes within industries, pattern of input structure was different for the two same five-year periods.

4. Structural changes between 1961-1966 and 1966-1971 periods were examined by multiplying the 1961 and 1966 structural matrices with the final demand vectors of 1966 and 1971 respectively. These hypothetical gross outputs were indeed different from the actual values.

It was concluded that: (a) the processed agricultural commodities, in general, have higher multiplier effects than other commodities; (b) the average growth rate of gross outputs between 1971 and 1980, for similar groups of industries, will be comparable to those between 1961 and 1971; (c) change in input structure within industries were different between 1961-1966 and 1966-1971 periods; (d) structural change between the two five-year periods: 1961-1966 and 1966-1971 had taken place.

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CHAPTER I

INTRODUCTION

Justification for the study

In recent years, economists have often been asked to predict with confidence the future needs of the economic system. The accuracy of such forecasts depends, to a large extent, upon the depth of understanding one has of the structure and organization of the economy as well as its complex interrelationships. While the future does not necessarily mirror the past, and the accuracy of any forecast is often constrained by those events which may or may not occur, the importance of selecting those regularities of the past which the economist feels will repeat in the future cannot be overstated. As such, the selection of these apparent regularities cannot but be enhanced by a thorough knowledge of the system with which one is dealing. Assumptions and/or conditions in forecasting are often the points of criticism. This certainly is not to imply that a forecaster must be bogged down in a morass of detail in identifying those regularities of the past which will repeat in the future, or setting aside conditions that are far from reality. Conditional forecasts arise from the fact that economists, through judgements, predict or expect certain future events and, in turn, forecast particular activities in the near or distant future. The fact that forecasts cannot be made unconditionally, is not any reflection on the progress of economic science. A set of forecasts with strong statistical confidence may well be distorted through exogenous forces.

The actual amount of information required for forecasting will depend on the type of forecasts to be made and the forecasting tool which is to be employed. In this latter regard, there are various tools, each with its strengths and limitations. One of the simplest methods available is partial forecasting which involves extrapolation a time series mathematically or graphically. This may work satisfactorily if the time series has been observed and has been proven to follow past trends. A good example of where this technique might be employed is sales forecasting for a short run period because of consumption patterns. Since long-run forecasting requires more than rudimentary knowledge, this particular method may be ruled out for anything but a short time horizon.

Another forecasting technique that is widely used is the econometric model. Such a model usually consists of a set of equations that are believed to describe the interrelationships between a number of variables. The equations often describe the simultaneous relationships between variables and hence an econometric model is sometimes known as a simultaneous equation model. The simplest example of this type of a model would consist of one demand and one supply equation where quantity demanded and supplied are both endogenous in the system. Such models are usually stochastic in nature in that an error term is introduced to allow for any discrepancies between the forecasted and the realized value. It might be appropriate to mention that in addition to the task of forecasting, econometric models are sometimes put through static and dynamic multiplier analysis where the effects on endogenous variables, both in the short and long run, are captured due to changes in policy and other exogenous variables. However, like all other models, econometric models also suffer from their specific limitations. Three main limitations are stability of parameters, stability of relationships among endogenous and exogenous variables, and an accurate method to forecast exogenous variables which in turn determine forecasts for endogenous variables. One further consideration is that an econometric model may be viewed as a problem solving model, i.e. a model that will answer only specific questions. For example, if a model were designed to forecast the demand for wheat, it would not be able to forecast the output of steel which would be necessary to meet the requirements of the agricultural implements industry to produce the tractors that would be used to produce wheat. Thus it can be seen that an econometric model will not provide a consistent and compatible set of forecasts for an entire economy at a particular point in time. This is not to denigrate the value of the econometric model, but merely serves to establish its limitations.

It can be seen, then, that if one is interested in obtaining forecasts for all industries in an economy, a tool other than the econometric model will have to be employed. One technique which will provide such overall forecasts is input-output analysis. An input-output table describes the inputs and outputs i.e. the interdependence of all the industries in an economy at a particular point in time. A conventional input-output table as designed by Professor Leontief, is a square matrix in dollar values with a one-to-one correspondence of industries. That is, if the third row in this table represents the Agriculture industry, then the third column will represent the Agriculture industry as well. The third column will depict the values of various inputs absorbed by Agriculture for production of output, whereas the third row displays the value of Agricultural output purchased by the various industries in the economy. In all cases, the value of total industry inputs just equals the value of total industry outputs. In other words, the table is based upon a double-accounting framework. We will not be concerned here with the details of an input-output framework. There are numerous references [26,40] that may be cited in this regard. The criticism, as we departed from the discussion of econometric models, was that these models cannot provide a compatible set of forecasts for the entire economy. With reference to input-output analysis, the point that should be brought to light is that an input-output system can provide forecasts of the outputs which will be necessary to meet the demands that are expected to stem from every part of the economy. We turn now to Professor Leontief's comments on this.

> "The analytical methods that are used to transform raw economic data into the final product of specific market forecasts and other types of economic projections are well known to economist-technicians (whom I would like to distinguish from political economists or economist-politicians). The large-scale data processing operation, which only a few years ago would have made the realization of the entire project unwidely, if not impossible, can be performed today rapidly and cheaply.
>
> But an important caveat is needed here. By their very nature, consistent porjections of the demand for good and services produced and consumed in all the many different, but mutually interdependent, sectors of the national economy cannot be run off as so many cars on on assembly line. Despite the use of electronic computers, the entire operation should first be visualized and organized like a construction job; all the parts have to be fitted skillfully to each other although no two of them are alike." [22.9]

Thus far we discussed forecasting with particular emphasis on the needs for consistent and compatible set of forecasts for the economy as a whole. In this discussion, one very important point has been imlictly assumed - the structure of the economy. Whether we speak of a mathematical relationship between variables in case of partial forecasting, in an econometric model or in an input-output context, each situation assumes or depicts a particular set of economic structure. It is needless to mention, cognizance of an economic structure leads to an accurate set of forecasts. Examination of an economic structure provides one with a set of answers in terms of performance of a whole system. Information from a structural analysis could be of significant value if:

(a) governments intend to carry out better planning activities in the future

(b) certain industries wish to explore the various activities of related sectors

(c) research is necessary in a certain sector for its continous poor performance

(d) policy changes are to be implemented

(e) each sector needs to be analyzed relative to all other sectors in an economic system.

As we speak of past performance and wish to analyze it, the job will be easier if there was a point of reference for the purpose of comparison. In other words, if we had two economic structures, or two identical input-output matrices say, sufficiently removed in time from each other then we can analyze the interim period. Consider two input-output matrices, for the same economy for two different years, expressed in a common base year price level. Now if the identical input coefficients were considered, the coefficients, in all likelihood, will show some discrepancies. This leads to a violation of an assumption in a Leontief system which suggest that the combination of inputs, will remain fixed whatever the level of output. It may be argued that due to improper deflation of the matrices such statistical problems may well appear. This is true to some extent because unavailability of proper indices often means that each cell of an input row is often deflated by the index number of the delivering industry whatever the type of input. But the problem does not get resolved with this. As new products emerge, relative prices rise and substitution takes place, shifts from one production process recipe to another occur. To a great extent these structural shifts are unknown and, the turning points of a certain well-followed economic relationship is discovered only after they have occurred. It is needless to say, much of this centers around technological change. For the purpose of this study, no distinction or inquiry will be made for the various kinds of technological change. We will treat this change as structural change in general, and focus upon the ultimate impact due to this structural change. As for the ultimate impact, our interest lies on the gross output vector. More specifically, since indirect demand is an input demand to produce gross output, with fixed final demand as indirect requirements change so do gross output levels. As we proceed, different concepts and expositions of structural change will be considered in Chapter II. Input-output analysis may be employed for examining structural changes as we shall see in Chapter II.

This study is based upon a rectangular input-output system. The rectangular system is one of the family of input-output models associated with Professor Leontief. This is a commodity-industry system where the number of commodities exceed the number of industries, as opposed to the more familiar square inter-industry system. The usefulness of a rectangular system will be dealt with in Chapter III. In this study, there are, three compatible input-output tables of the Canadian economy for the years 1961, 1966 and 1971. These tables describe 35 industries and 134 commodities aggregated from 191 industries and 595 commodities respectively. The value of commodities may be viewed as inputs to industries or products of industries. There are 4 primary inputs respectively aggregated from 7 primary inputs. It should be pointed out that although the inputs and outputs of agricultural commodities and industries are represented at a relatively low level of aggregation, the picture of the non-agricultural sectors is rather a highly aggregated one. However, this does not cause any complications for it is the agricultural and related sectors that are emphasized in this study.

Objectives

The objective of this study is threefold. First is that of forecasting industry outputs for 1980 based upon the structural matrix of 1971. We cannot make use of a more recent structural matrix due to data unavailability. There are two forecasts, as we shall see - one is based upon projected final demand of 1980 based upon final demand of 1966 and 1971. The second is due to projected final demand of 1980 based upon final demand of 1961, 1966 and 1971.

The second objective is to explore the change in input structure both primary and intermediate over the years 1961 to 1966 and 1966 to 1971.

Third, we study the impact of the structural matrix of a different year upon industry outputs given an identical vector of final demand. More explicitly, we are concerned with the question that: would there be any changes in the industry output vector of 1966 if final demand of 1966 was to be delivered with the 1961 structural matrix? Similarly, a second question is concerned with the behaviour of industry outputs if final deliveries of 1971 were to be met with the structural matrix of 1966. Essentially then we are comparing a vector of industry outputs produced under two different economic systems sufficiently removed in time from each other. As time goes on, and input requirements change over time, a change will be captured in the output vector produced for the same bill of goods. It may be pointed out that the second and the third objective are interrelated for the third is a function of the second. Insofar as this study is concerned, the interest lies in capturing the ultimate effect of structural change between 1961 through 1966 and between 1966 through 1971 upon all industries. The particular cause of structural change in any particular industry or industries will not be examined.

Organization of the study

Having stated the objectives of this thesis, it remains to be indicated how the steps are taken to achieve them. Chapter II will deal with a detailed review of literature pertinent to this thesis. Chapter III will focus on the usefulness of a rectangular input-output system and will include a general output determination model of this particular type of system. The methodology based upon this general model is dealt with in Chapter IV, Chapter V briefly examines the data structure. Chapter VI includes a discussion of the results which were obtained. Finally, there are three appendicies. Appendix A displays all results. Appendix B contains the complete disaggregation of all commodities and industries used in the analysis. Appendix C includes the data base used in the study.

CHAPTER II

REVIEW OF LITERATURE

There exist a number of studies that have used input-output analysis to forecast gross output or intermediate demand or final demand. Input-output analysis has also been used to examine structural changes. This chapter reviews studies that are relevant to this thesis. Before proceeding to particular studies, discussion of a few points is warranted. After an extensive search, no study that uses a rectangular input-output scheme to forecast or to examine structural changes has been found. The review of studies presented are, therefore, limited to classical inter-industry Leontief models. While similarities in mathematical models between the studies reviewed and this particular study may not be found, the objectives remain similar. This limitation, it is hoped, will not be detrimental to the objective of this chapter. For the sake of clarity on notation, we will write $(I-A)^{-1}$ as the standard inverse of the unit minus the intermediate input coefficient matrix and refer to this as the 'inverse matrix' or 'the Leontief inverse' throughout this study. As for mathematical exposition, equations are borrowed directly from the respective study wherever necessary.

Review of Studies On Forecasting

With the above points in mind, we first refer to a study by Tilanus [37]. He performed forecasting experiments for the Dutch economy. Tilanus placed a great deal of emphasis on the statistical properties of the errors between the predicted and realized values. Our discussion will be specific to the forecasting experiments and, therefore, the reader is encouraged to refer to the study with regards to the statistical methods. The first aspect of the study was to predict intermediate demand after predicting final demand of the particular year. Two methods were introduced to calculate intermediate demand. Let us denote gross output vector, intermediate demand matrix and final demand vector by X, z and f respectively. Then,

$$z = \frac{z}{f} f, \text{ for year } t \qquad (2.1)$$

It was assumed that $\frac{z}{f}$ would remain constant between year t the base year and, year t+k the year to be predicted. Therefore, for year t+k, intermediate demand will be proportional to final demand in relation to the base year t. Mathematically,

$$z_{t+k} = \left(\frac{z}{f}\right)_t f_{t+k} \qquad (2.2)$$

In the second method, intermediate demand for year t+k was predicted with given final demand for year t+k. It is correct to write,

$$z_t = ((I-A_t)^{-1} - I)\, f_t \qquad (2.3)$$

where z_t, A_t and f_t represent the intermediate demand vector, matrix for intermediate input coefficients and final demand vector respectively for year t. It was proposed that,

$$z_{t+k} = ((I-A_t)^{-1} - I)\, f_{t+k} \qquad (2.4)$$

The basic difference between the two methods is that, in the first method it was assumed that the intermediate demand will be proportional to final demand for the year t+k as in year t.

In the second method, the base year inverse was assumed to remain stable between years t and t+k. It was concluded that the second method works out better as long as the inverse was not more than two years old. Input-output tables for the Netherlands were available for the years 1948 through 1957. The inverse matrix for each of these years was introduced in (2.4) to calculate intermediate demand for 1958 with estimated final demand of 1958. The first method is similar to the concept of GNP blow-up and is referred to as final demand blow-up. We will discuss the method of GNP blow-up later in this chapter. Tilanus' experiments were based upon input-output tables of dimension 35 x 35, however, only 27 sectors were projected because intermediate demand of the remaining 8 sectors were considered unimportant. A comparison between the errors computed from the final demand blow-up and input-output estimates suggests that the latter is a better choice.

The second problem dealt with the value prediction of primary demand: Imports, Wages (aggregated from Wages and Salaries, and Employer's social insurance fees) and Gross profits (aggregated from Depreciation allowances, Intermediate taxes, Subsidies, Net profits and Interest). Denote the flow from primary sector i into industry j by p_{ij} and this matrix by P, and the corresponding primary input coefficient by b_{ij} and this matrix by B then,

$$B = PX \tag{2.5}$$

We know that,

$$z + f = X \tag{2.6}$$

and,

$$X = (I-A)^{-1} f \tag{2.7}$$

Substitution of (2.7) in (2.5) suggests that for the year t+k,

$$B_{t+k} = P_t \ (I-A_t)^{-1} \ f_{t+k} \tag{2.8}$$

where matrices P_t and A_t suggest that primary and secondary input coefficients are for the base year t and, the final demand vector f_{t+k} is given for the year t+k. There is no specific mention of the predicted year by Tilanus. It should be noted that the final demand vector f_{t+k} will serve both for predicting primary and intermediate demand for the same year. In addition to the input-output scheme, a procedure of the blow-up type was employed as an alternative approach to predict primary demand for the same year. It was again assumed that the proportion of primary demand to final demand will remain constant for the year t+k as in year t, suggesting that:

$$P_{t+k} = \frac{P_t}{f_t} f_{t+k} \qquad (2.9)$$

a comparison between the input-output and the blow-up procedure again suggests the input-output method yields better estimates.

Thirdly, the primary demand vector was predicted given final expenditure. Thus far we have considered a single vector f for final demand. This vector sums across the columns of the each sub-sector of final demand. We can also speak of a final expenditure columns which is the sum over the rows for a particular column in the matrix of final demand. More clearly, if household consumption is a column in a final demand matrix then, the total final expenditure on household consumption is the sum over this column for all industries. Let the flow of the ith industry to the jth sector of destination in a final demand matrix be f_{ij}, the total final expenditure on the jth sector be g_j, c_{ij} the appropriate coefficient and C the corresponding matrix. Then,

$$C = c_{ij} = \frac{f_{ij}}{g_j} \qquad (2.10)$$

Substitution for the vector f from (2.10) in (2.8) gives,

$$B_{t+k} = P_t \ (I-A_t)^{-1} \ C_t \ g_{t+k} \qquad (2.11)$$

It should be clear that g_{t+k} denotes total estimated final expenditure for the year t+k. However, there is no specific mention of the methodology for predicting final expenditure and, this places a constraint on the discussion for predicting the vector g. Equation (2.11) projects the vector of primary demand with given final expenditure. A ratio was calculated by dividing the vector of primary demand obtained from the final expenditure prediction by the vector of primary demand obtained from the final demand prediction. This ratio was quite close to unity indicating that neither method is particularly superior. In each of these predictive experiments, Tilanus fails to mention the particular methodology employed in forecasting the primary or the final demand.

The last section dealt with forecasting volume prediction of intermediate demand given final demand. If we denote the secondary coefficient by a_{ij} then,

$$a_{ij} = \frac{z_{ij}}{X_j}$$

$$= \frac{q_{ij}p_i}{q_jp_j} \qquad (2.12)$$

where q_{ij} is the volume of flow from sector i to j, p_i is the unit price of input i, q_j is the total production in quantity terms of sector j and p_j is the unit price of sector j repectively. It should be perfectly clear that, the p's here are prices and not primary inputs discussed earlier. It was assumed that volume coefficients were constant for the base year t to the year t+k. In other words,

$$a_{ij}(t+k) = \frac{q_{ij}(t+k)\ p_i(t+k)}{q_i(t+k)\ p_j(t+k)} \qquad (2.13)$$

or,

$$a_{ij}(t+k) = \frac{q_{ij}\ p_i(t)}{q_j\ p_j(t)}\ \frac{p_i(t+k)}{p_j(t+k)}\ \frac{p_j(t)}{p_i(t)} \qquad (2.14)$$

where aij(t+k) is an intermediate input coefficient for year t+k. The ratio of prices were treated as diagonal matrices and denoted by a circumflex sign. By postmultiplying we write,

$$A_{t+k} = \hat{p}_t\ A_t\ \hat{p}_t^{-1} \qquad (2.15)$$

where A_{t+k} is a matrix of input coefficients for year t+k, a_t for year t and $\hat{p}_t$ is a diagonal matrix of price ratios p_i/p_j for year t. Again, it was assumed that $A_{t+k} = A_t$

Substitution of (2.15) in (2.4) gives

$$z_{t+k} = ((I - \hat{p}_t\ A_t\ \hat{p}_t^{-1})^{-1} - I)\ f_{t+k}$$

$$= ((\hat{p}_t\ \hat{p}_t^{-1} - \hat{p}_t\ A_t\ \hat{p}_t^{-1})^{-1} - \hat{p}_t\ \hat{p}_t^{-1})\ f_{t+k}$$

$$= (\hat{p}_t\ (I - A_t)^{-1}\ \hat{p}_t^{-1} - \hat{p}_t\ \hat{p}_t^{-1})\ f_{t+k}$$

$$= \hat{p}_t\ ((I - A_t)^{-1} - I)\ \hat{p}_t^{-1}\ f_{t+k} \qquad (2.16)$$

where f_{t+k} is again the predicted final demand vector. Using equation (2.16), volume prediction for the year 1958 was made. Now the errors between the predicted and the realized value of intermediate demand were compared to the errors between the predicted and the realized volume of intermediate demand. Mean errors for volume predictions were larger than the value prediction. Tilanus suggests two reasons for this. First is that the value coefficients in constant prices are believed to be more stable than the volume coefficients. The second is that lack of data necessitated use of appropriate price indices for the diagonal matrices and this might have introduced some bias. Consider the input from Chemicals to Agriculture, this flow consists of fertilizer, pesticides and other typical chemicals used by the Agriculture sector. Unfortunately, the various components of such an input is almost never found in an input-output matrix. As for data availability, there exists a price index for the Chemicals industry, but not individual index for fertilizer or a particular chemical. Ideally for each volume flow q_{ij}, there should exist its own price index p_{ij}. In reality however, index number of the Chemical industry was needed to represent the prices of the products of this industry used as inputs by all other industries. On the other hand, insofar as the output is concerned, there is no particular difficulty in applying this treatment if homogeneity of output is assumed.

Before proceeding to the next study, we recall that one of the objectives in this thesis is to forecast gross output for 1980 after forecasting final demand for 1980. One common ground between Tilanus' study and this thesis could have been the similarity or difference in the methodology in forecasting final demand. As stated earlier, Tilanus does not describe the particular methodology employed in projecting final demand. We could, therefore, only summarize the described framwork.

Cornfield, Evans and Hoffenberg [8] attempted to estimate the impact of full employment upon the United States economy in 1950 based upon a 28 x 28 input-output matrix of 1939. The authors maintain:

"The present estimates are consequently neither fore-

> casts, a statement of present government intentions, nor a model of an ideal structure of government revenue and expenditure. They are best interpreted as an approximate picture of what might happen under full employment conditions in 1950 if there were no basic change in the scope of government activities from the prewar period, except those alterations which are an aftermath of the war itself." [8:173-74]

For the sake of similarity, the objective of forecasting in this thesis may also be viewed as an approximate picture of the Canadian industries in 1980 if the final demand between 1971 to 1980 grows at the same rate as it did between 1961 to 1971 or between 1966 to 1971. The ultimate objective of the study of Cornfield et al. was to obtain a statistical picture of output and employment in different industries under full employment conditions. The authors suggest that the main components that determine employment are: income - consumer, corporate and government; and demand - consumer, export, government, capital goods and gross output. Looking at it from another angle, demand determines employment. Therefore it is quite conceivable that while forecasting a statistical picture for the future, the main thrust may be placed on the demand analysis. The authors put forward two different estimates of final demand, namely, consumer demand and investment demand. The consumption model fixes the investment demand and the government demand and, augments the estimated consumer demand by the amount necessary to achieve full employment. The investment model, on the other hand, fixes the consumer demand and augments the investment demand by the amount necessary to achieve full employment. The assumption made on the consumption model was that an increase in the level of expenditure between 1939 (the base year) and 1950 will be relative to income, i.e. a point at which income and expenditure are equal. There were four assumptions made on the investment model side. First, between 1939 and 1950, construction activity would rise by two-thirds. Second, final demand for durable goods would rise by over fifty percent. Third, exports would rise by twenty percent. Finally, the inventory change was held constant. An important point is, with regards to these assumptions,made by the authors. The fact that consumer demand would rise relative to income reflects more of a structural change than those assumed in the investment demand model. The case in point is that, as consumer income rises so does expenditure, but perhaps up to a point lower than income. In addition, expenditure on certain goods rises more rapidly than others. A suggestion with regards to similar studies is that it may be helpful to study the spending habits of families of different income distribution. An example cited here by the authors is that between 1935 to 1936, families with income below $1,250, incurred deficits, but as income rose above that amount, saving rose quite rapidly. Savings were 10, 20 and in excess of 40 percent at incomes of $2,500; $5,000 and $20,000 respectively. On the investment model side, the key components are - durable goods, construction, inventories and exports. The thrust of this model is not on forecasting the output of durable goods, but rather on the prediction of level of employment which would be generated from maintenance of these goods.

The framework of the analysis follows certain guidelines. As mentioned before, since all findings stem from the nature of final demand in 1950, mostly judgement was used in recognizing the characteristics and the behaviour of the American people in 1950. Past performance i.e. buying habits, preferences etc. were used throughout the study to arrive at the estimated final demand. The estimates of final demand were in terms of final product and not in terms of raw materials. Through the estimates of final demand, an estimate of gross output for 1950 (in 1939 dollars) was obtained. Unfortunately, the authors do not explicitly state the method of obtaining this gross output vector and, therefore, we assume that this is done by multiplying the estimated final demand vector with the inverse of 1939 (the base year). Let us quickly point out the key points. Although 1950 employment estimation is the main objective of the study, we will primarily concern ourselves with looking at the aspect of final demand and gross output.

First, on the consumption model, it was found that to facilitate full employment in 1950, consumer demand in 1950 would have had to rise by 20 percent in excess of 1939 final demand. Again, comparisons were carried out in 1939 dollars. The authors believe that the following three reasons constitute this 20 percent increase:

(a) an upward shift in consumption expenditure with respect to income.

(b) a shift toward more equality in income.

(c) increase in transfer payments without raising the taxes by the same amount.

Since the third case calls for a change in public policy, it was ruled out as a basis for estimate. An estimate of final demand based on the first two hypothesis were carried out under the assumption that an overall 20 percent increase in demand is possible if the expenditure was spent on goods of the different industries.

On the investment demand side, in order to facilitate full employment, the demand for capital goods had to rise by two and one half times the 1939 level. In summary, although the overall change in final demand of 1950 estimated through either model was comparable, the individual industry demand varied significantly. Tracing up to the gross output level, it was found that the output levels for 1939 and 1950, both in 1939 dollars, are different for different industries depending upon which of the two final demand model was chosen. Agriculture and Fishing, Food processing, Testile products, Leather products would have had to produce a significant percent (35+) in excess of 1939 output if the consumption model was chosen; where as the industries producing the metal goods had to produce a significant percent (56+) in excess of 1939 output if the investment model was chosen. Since a high level of gross output dictates a high level of employment, it is quite conceivable that the employment pattern for 1950 ultimately depended upon which of the two final demand estimates was chosen. The reader is encouraged to refer to the study directly for a detailed discussion on employment patterns.

We will now very briefly mention a study by Barnett [4] which is a direct derivative of Cornfield, Evans and Hoffenberg's project. It was found in the study of Cornfield et at. that total final demand for 1950 would be 86 percent greater than that of 1939 if final demand for 1950 represented a consumption model and, 79 percent greater if final demand represented an investment model. Barnett followed three techniques for projecting 1950 industry output.

First, multiple regression method was used to calculate gross output with the following approach

Specific industry out = a + b GNP + c Time. In this relationship, there would be two sets of GNP depending upon which final demand model is chosen.

Second, a methodology known as GNP blow-up was followed. This methodology assumed industry output in 1950 to be proportional to GNP in 1950. In other words,

$$\frac{\text{Projected industry output in 1950}}{\text{Actual industry output in 1939}} = \frac{\text{Projected GNP in 1950}}{\text{Actual GNP in 1939}}$$

Again, there were two sets of GNP arising from two different final demand patterns - consumption and investment.

Third, a method noted as final demand blow-up was used. We recall again that 1950 final demand estimates (in 1939 dollars) varied significantly from 1939 final demand, depending upon the type of final demand pattern. Generally it was mentioned that, output of metal working sectors were higher insofar as the investment model was concerned. This is quite conceivable because higher construction levels indeed require higher output from metal working sectors. In this final demand blow-up procedure, percentage change in final demand between 1939 and 1950 was calculated for both consumption and investment oriented economy. It was now proposed that if Agriculture in 1950 (1939 = 100) were to produce 52 percent over 1939 output for a consumption model and 39 percent over 1939 output for an investment model then, the change in output of this industry in 1950 will be proportional to the respective rise in final demand. This assumption is inherent in a Leontief system maintaining proportional rise on the supply side.

The fourth vector of output was not calculated but directly borrowed from Cornfield et al. This vector, we recall, was necessary to achieve full employment in 1950. This output vector may be called a full employment pattern vector. As for comparison, there were eight output vectors, rising from two different final demand patterns. If each output was weighted by the relative share in the total 28 sectors then, the mean percent error between 1939 and 1950 suggested that multiple regression was more accurate, compared to full-employment pattern, final demand blow-up and GNP blow-up. For unweighted comparison, full employment pattern and final demand blow-up methods were better than those of multiple regression and GNP blow-ups.

Adams and Stewart [1] performed an ex post forecasting of real outputs for the years 1924, 1930, 1933, 1934 and 1935 based upon an inter-industry table of 1935 developed by Barna [3]. This table for 1935 was of size 36 x 36, however, Adams and Stewart depict forecasts only for 34 sectors. The years chosen were primarily due to the availability of gross output estimates from Census of Production. This facilitated comparison of estimated values to Census estimates. The method for obtaining the gross output vector was essentially multiplying the inverse matrix for 1935 by the estimated final demand vectors. For each of the years, there were, five categories of final demand. Four of these were: consumers' expenditure, government expenditure, export and capital formation. The fifth category was somewhat awkward to the extent that it was sum of two elements: first, it had inventory change of capital formation and, second, it contained the unallocated part of each industry's gross output. A reasonable amount of work was necessary to estimate the first four categories of final demands. As for the fifth category, an assumption was made. It was assumed that for 1924, 1930, 1933 and 1934, the proportion of change in inventory to total output was the same as in 1935 - the base year. This implied that actual changes were ignored. Furthermore, since no split between inventory changes and unallocated input could be obtained, it was also assumed that the share for unallocated remained the same for the base year. The final demands for all the years were brought to 1935 price level. These final demands were then multiplied by the inverse of 1935 to arrive at the total output vector at constant prices (1935). The difference between total output and final demand, i.e. intermediate demand was also obtained. These gross outputs were then compared with those obtained from the census data. The comparison was not absolutely complete because the census figures were not available for each sector for each year.

Percentages depicting errors between the census (A) and input-output estimates (B) were calculated as $((B-A)/A) \times 100$. The errors were relatively higher for the years 1924, 1930 and 1933 than for the year 1934. This, the authors believe, is due to changes in technical coefficients. No error index was calculated for 1935 - the base year.

The second focus of this exercise was placed on projecting employment and imports. For employment projections, only two years were selected, 1924 and 1930. First, employment coefficients from the 1935 table were multiplied by the gross output vector to yield total employment. Secondly, it was assumed that employment moves proportional to gross output of 1924 and 1930. Comparison of both estimates to actual employment figures suggests that neither method yields satisfactory results.

Finally, competitive imports were estimated for the years 1924, 1930 and 1935. This particular section is somewhat unclear. The reason is that the authors speak of volume prediction and fail to report the particular methodology used. In addition, the authors speak of total volume imports for all sectors. It is indeed possible to calculate individual volume estimates by industry. But it would be rather difficult to consolidate individual volume estimates for each industry. However, since the comparison of estimated imports were made to an index number (1935 = 100), one can assume that first, value of import by each industry was calculated and, a volume index was then constructed. In the framework adopted here, imports were treated as negative exports. The ratio of value of import absorbed by each industry (found in the import row of [3]) to the value of total output shows direct import coefficient. Multiplication of the import coefficient row by $(I-A)^{-1}$ yields the total import content of each sector.

> "The import content of total output were calculated for 1930 and 1924 by applying these import-content coefficients for 1935 to the final demand for those years, covering all thirty-six sectors in the 1935 input-output table." [1: 453]

Comparison was next made between the index number of import requirements and an actual index (1935 = 100). Again, the exact methodology for arriving at this index number remains unclear. The comparison showed that estimates were relatively more accurate between 1924 and 1930 than between 1930 and 1935. The reason for this, the authors suggest, is because relative prices and trade policies determine import levels. During the Great Depression i.e. between 1930 and 1935, relative prices of competitive imports rose higher than between 1924 and 1930. In addition to large changes in price structure, British trade policies were different between 1924 and 1930 than between 1930 and 1935. A concluding comment suggested by the authors is that the input-output method for estimating imports is of little use when there are extreme changes in price structure.

Sevaldson [30] tested a Norwegian input-output model based upon an input-output table of dimension 30 x 30 for 1948. Two compatible tables, for the years 1947 (in 1948 prices) and 1948 were compared. The comparison, in the main, showed little discrepancy between coefficients indicating stability of coefficients. Final demands of 1947 inflated to 1948 prices, were multiplied by the 1948 inverse to obtain the 1947 gross output vector. Among the 30 sectors compared, outputs of 23 sectors were between 95 and 105 percent of the actual figure. These results were then compared to the results obtained through two other methods. The first method necessitated estimation of gross output in each sector as the same percentage change in final demand between 1947 and 1948. In the second method, gross output in each sector was estimated as the same percentage change in intermediate demand as between 1947 and 1948. The estimate of gross output through the input-output method was better than those by the two alternative methods described above.

Finally, we will touch upon Almon's [2] document which, through regression and input-output analysis, predicted the economic activities for the American economy for 1975. It may be pointed out at the outset that, along with the commendations that Almon's work deserves, certain criticisms can be made. Firstly, certain results are not published. Second, and most important, the objectives though clearly stated are, never linked with the actual model, and therefore, only the best understood framework related to the input-output model will be our concern here.

Almon's analysis consisted of a ninety sector input-output table of the American economy where the base year was 1963. Again, part of the results on constant dollar sales by industries are not published. The ultimate end product is an input-output table of 1975 which shows two rows for each sector. The first one depicts the fraction of sales (i,e, percent) of each industry which would have gone to the various industries in 1975 and, the second row depicts the growth rate of that particular industry.

Having discussed the ultimate findings of this study, we take a few steps back. In this study, the emphasis was first placed on what Almon calls structural forecasts. Almon maintains that structural foecasts are of a per-dollar sort, these forecasts describe the functioning of the economy given certain conditions. The conditions are:

(a) changes in consumer expenditure for per dollar of additional income.

(b) changes in capital spending required per dollar of sales expansion.

(c) changes in material requirement per dollar of sales.

(d) changes in labor requirement for a change in per dollar of sales. [2:;3-15]

In summary, the following steps were taken in the analysis to develop the sales forecasts. First, judgemental forecasts are carried out for government expenditure.

Second, a trial projection of after-tax income was picked, and consumer expenditure per person on the product of each industry for the year of the forecast was calculated. Multiplication of the population estimate by per person expenditure gives the final personal consumption.

Third, a trial projection of industry sales for the year of the forecast period was picked and investment, construction spending and inventory accumulation calculated.

Fourth, it should be clear that the last three steps pivot around the final demand. Here the rows of the final matrix were added to get one final demand column vector for the year of the forecast. The next step was to multiply the final demand column vector by the base year (1963) input-output matrix to arrive at an industry output vector.

Fifth, now a comparison was made between the output vector obtained from step four and that assumed necessary for the investment forecast in step three. If the discrepancy was significant then the output from step four was used to recalculate investment and again arrive at industry sales. This process was repeated until the comparison was satisfactory. Almon points out that one iteration has been sufficient to yield satisfactory results for many sectors.

Sixth, a mathematical model (other than input-output) was built to calculate total employment. This figure was compared with the employment calculated from the input-output model. If the comparison was not satisfactory then the after-tax income in step two was altered to yield a different level of consumer demand which yields different total final demand, which again yields different total output which finally gives rise to a different vector of employment. Again, Almon does not mention the kind of mathematical model used to calculate total employment.

Review of Studies On Structural Change

It was stated earlier that one of the objectives of this study was also to explore the structural changes in the Canadian economy between the two year periods: 1961 to 1966 and 1966 to 1971. Before proceeding to particular empirical studies on this premise, it is appropriate to discuss this concept. This discussion, it is believed, will help the reader understand the gists of the literature reviewed and the work of this project.

Sakai [29] discusses and distinguished between structural change and other economic changes. According to Sakai there are four forms of economic changes [29:86]:

(a) Seasonal variation

(b) Cyclical fluctuation

(c) Trend

(d) Long wave

Seasonal variation is short in duration and is believed to repeat itself. An example of this is the rise in retail sales during December. It is a phenomenon which is unlike or different than retail sales during other months of the year. The rise is not due to structural change because structural change is believed to be a fundamental change which brings significant changes in the economic system.

Cyclical fluctuation is similar to seasonal fluctuation except that the former occurs in a rhythm which is farther apart than that of the latter. This change repeats itself from time to time and some inference could be made regarding the next occurence or the length of a cycle. On the other hand, structural change does not repeat itself in a similar fashion such that it could be predicted.

If cyclical fluctuations along with the seasonal variations are observed, there appears the phenomenon of trend. Trend is a statistical curve, a slow moving function of time that disregards the seasonal and cyclical variation. It is often a curve of a polynomial of a low degree which suggests some growth over time. The question is: does this growth represent structural change? The answer is no. This phenomenon indeed has structural elements which suggest some relationship between variables and time in a national economy. This relationship is an ongoing process and, not a fundamental movement which is the case with structural change. It may not be argued that the nature of the statistical curve represented in trend is a function of structural change. However, it may be that as structural changes occur, trend is accompanied by these changes.

A long wave, as the term suggests, is the long term behaviour of business cycles representing ten, twenty or thirty years. Use of a long wave may be made to represent general economic conditions. It must not be denied that the effects of structural change are indeed captured in a long wave.

In the preceeding discussion we have established that structural change is something (a) that causes fundamental changes in an economy, (b) that does not repeat itself with some particular pattern, (c) that cannot be predicted, (d) that will leave an economy with significant changes in its structural elements.

With these points, we turn to somewhat more particular discussion. Leontief[20] was one of the first to employ input-output techniques in capturing structural change in the American economy between 1919 and 1939. Leontief's central idea is still the basic framework for many economists exploring structural changes. The framework on structural change used in this thesis springs from Leontief's work. On structural change Leontief maintains:

> "Comparing the structure of an economic system in two stages of its historical development sufficiently removed from each other, one might easily find them to be as unlike as a butterfly and a caterpillar. Not only the relations between the separate sectors of the economy, between the various commodities and services, will have changed, but more than that, the commodities and services found in two stages might turn out to be entirely dissimilar. A quantitative comparison, a measurement of the difference between the two stages, would in such a case be out of the question. This does not mean, however, that the relation between such entirely dissimilar stages in the historical development of a particular economic system cannot be analyzed and explained. Such analysis and explanation is possible because of the fundamental continuity of the process of change itself. However different the goods and services observed at the opposite ends of a long chain of economic transformation, its successive links are necessarily intermeshed. 'New' commodities would not have been introduced at all if they could not be, and actually had not been, produced from the 'old' commodities and services, on the one hand, and if they were not put to some 'old' uses, replacing as inputs some of the previously produced goods, on the other. How many potential new products are confined to the disembodied existence of the blueprint stage because no practical way has yet been found to produce them by known methods from actually available inputs or because they cannot be directly or indirectly used in turning out some already produced and consumed commodities as services?" [20:20-21]

Carter's [5,6] work on structural change owes much to Leontief's as we shall see in our discussion. Carter maintains that if structural changes were to be studied in light of input-output analysis then structural change will have impact on input-output tables causing the coefficients to change due to substitution. [6:11]

Staglin and Wessels [31] point out that as structural change occurs, the input-output coefficients begin to change. Furthermore, the repercussion of structural change does not stop with the changes in direct input coefficients alone, the repercussion is captured in the inverse coefficients as well. Technological change certainly triggers structural change. If change or shifts in individual direct coefficients for one sector was to be studied, it is possible to focus with a narrow interest and study the impact of technological change. However, measuring structural change may necessitate studying changes in inverse coefficients for all sectors.

Having arrived at a suitable definition of structural change, we now proceed to present summaries of a number of studies that have empirically attempted to measure structural changes. Before proceeding any further, we should recall that in this study, the objectives dealing with the structural changes in the Canadian economy investigate two aspects. Firstly, we examine the changes in input requirements of all industries between the two five-year periods: 1961 to 1966 and 1966 to 1971. Secondly, we examine the changes in gross production given an identical vector of final demand. That is to say, the 1961 inverse matrix is multiplied by the final demand of 1966 to derive a 1966 gross output vector. When this derived gross output vector is compared with actual 1966 gross output vector then, this comparison is due to changing coefficients between 1961 to 1966. A similar operation is carried out between a derived and an actual gross output vector of 1971 to compare the changes in all industries due to changing coefficients between 1966 and 1971. A final remark that should be made here is that for both aspects on structural change, all input-output tables and final demand matrices were deflated to 1961 prices to facilitate compatible comparisons.

In his classic input-output study on the structure of the American economy between 1919 and 1939, Leontief [20] measured structural change in the economy in terms of the changes which took place in the input-output coefficients over successive time periods. All tables (1919, 1929 and 1939) were brought to 1939 prices. The easiest way to measure the change in an input coefficient between two points in time is simply to find the difference between its magnitude in the original and final period. Leontief points out that this kind of measure would be of little use in comparing the changes in two or more different coefficients because the absolute magnitude of any one of them depends upon the physical units in which the output and the input quantities are described [20:18]. To overcone this difficulty, Leontief suggests that the differences be expressed in percentage terms, with the differences divided by the mean of the two coefficient values to eliminate the possibility of dividing by zero, should the value of a coefficient be zero. In other words, the index of relative change in technical coefficients between the two years, say 1919 and 1929, can be expressed as:

$$\frac{a_{ik} - a^*_{ik}}{(a_{ik} + a^*_{ik})/2}$$

where a_{ik} is the input of the ith industry for the production of the unit output of the kth industry in 1929, and a^*_{ik} is a similar coefficient of 1919. Without placing much emphasis on this measure of percentage change among input coefficients, Leontief introduced another unique measure of structural change. Suppose Agriculture was an industry in his analysis. The column of direct input coefficients for the Agriculture industry would be replaced by the identical column of 1919 in the entire 1929 input coefficient matrix. This matrix was used to obtain $(I-A)^{-1}$ and the inverse was then multiplied by 1929 final demand. What does this yield? A derived gross output vector of 1929 that would have been produced in 1929 to satisfy the final demand of 1929 if Agriculture alone was operating with 1919 structural pattern. In the next step, the columns of Ferrous metal industries were replaced with 1919 coefficients and a similar operation was carried out. This process was iterated until the whole 1919 inverse matrix (14 x 14) was multiplied by the 1929 final demand vector. A similar process took place between 1929 and 1939.

Finally, Leontief examined the derived output vector of 1919 and compared it to the actual output vector of 1919. When Agriculture, Heavy metal industries, Nonferrous metals and Nonmetallic minerals, Fuel and Power, Light industries (Textile and Lumber) and Transportation industries' 1919 input coefficients were introduced one at a time in 1929 matrix then, Agriculture would have had to respectively produce 14.6, 16.6, 14.6, 20.8 and 14.6 percent in excess of 1929 gross output to satisfy 1919 final demand vector.

As the 1919 inverse as a whole was multiplied by the 1929 final demand vector, Agriculture would have had to produce 22.1 percent in excess of 1929 gross output to satisfy 1919 final demand. It was found that the necessitated change in gross outputs in 1929 to satisfy 1939 final demand was smaller than the respective change in gross outputs if 1929 final demand was to be met in 1919.

Carter's [6] work owes much to Leontief. With Leontief's study being the central idea, Carter proceeded to explore structural changes of the American economy between 1939 and 1947, 1947 and 1958, and 1958 through 1961. The data structure for 1958 and 1961 were perfectly compatible. The 1947 table was a very detailed one, encompassing 450 sectors. For all years, there were three orders of data structure representing 38, 76 and 98 sectors. The sturcture of data was hierarchial to the extent that the 98 order could be aggregated to the 76 order and, the 76 order to the 38 order in turn As for comparison between two particular years, orders of different size could have been considered. To facilitate homogeneous comparison between all years the 38-order classification was chosen. All tables were also brought to the 1947 price level. The use of the inverse was made to explain structural change between years. In this regard, Carter points out two very fundamental points bringing out the merit and demerit in explaining structural changes through the Leontief inverse [6:26]. First, the measure of structural change captured through the inverse matrix has advantages over direct coefficient comparison. As statistical procedure for keeping the record of flows change, the flow for the identical cell in two different years may not be compatible. In addition, industries do change their buying habits insofar as the source of the input is concerned. A comparison of inverse matrices between two years depicts direct-plus-indirect requirement changes between the two years. As for demerit, comparison through inverse coefficients indeed distorts the picture to the extent that the primary focus of change cannot be followed. Increase in direct-plus-indirect requirements of a particular good is somewhat difficult to explain because, it is almost never known which sector(s) in particular dictates this increased use.

Firstly, an attempt was made to capture the changes in intermediate demand for the years 1939, 1947 and 1958 to satisfy 1961 final demand. If we denote the matrix of intermediate inputs, gross output and final demand vectors by z, X, and y respectively then, for year t,

$$X_t = (I-A)_t^{-1} y_t \quad (2.17)$$

$$X_t = z_t + y_t \quad (2.18)$$

$$z_t = (I-A)_t^{-1} y_t - y_t \quad (2.19)$$

Carter puts forward the following question: what would have been the value (in 1947 prices) of z_t for the years 1939, 1947 and 1958 if y_t was held constant for the year 1961. In other words,

$$z_t = (I-A)_t^{-1} y_{1961} - y_{1961} \quad (2.20)$$

$$t = 1939, 1947, 1958$$

The respective values of z (in 1947 millions of dollars) for the years 1939, 1947, 1958 and 1961 were 328,288; 336,296; 336,941; and 334,160, [6:36] indicating that as time goes on, more intermediate inputs were required. The shift, as we shall see, was towards using less labour inputs.

The second question is with regard to necessary labour requirements in 1939, 1947, 1958 and 1961 to satisfy 1961 final demand. In matrix notation, if E denotes total (direct-plus-indirect) employment in an economy, e a vector of labour input per unit output. Then,

$$E = e\ (I-A)^{-1}\ y \quad (2.21)$$

The total labour requirements (E) that would have been necessary in 1939, 1947 and 1958 to satisfy 1961 final demand could be expressed as follows:

$$E_t = e_t\ (I-A)_t^{-1}\ y_{1961} \quad (2.22)$$

$$t = 1939, 1947, 1958$$

The comparison was made in millions of man-years. The actual figure on employment 1961 was 58 million man-year whereas, in 1939, 1947 and 1958 - 101, 86 and 63 million man-years would have been respectively required to satisfy 1961 final demand.

The third exploration dealt with examining total capital requirements. If total capital requirement vector is k, capital coefficient vector per unit output is b then,

$$k = bX$$
$$= b\ (I-A)^{-1}\ y \qquad (2.23)$$

Continuing on the same notation form we write:

$$K_t = b_t\ (I-A)_t^{-1}\ y_{1961} \qquad (2.24)$$
$$t = 1939,\ 1947,\ 1958$$

A comparison suggests that capital requirements fell more sharply between 1947 and 1958 than between 1939 and 1947 to satisfy final demand of 1961.

The fourth inquiry was made with regard to necessary intermediate inputs in 1939, 1947 and 1958 to satisfy particular categories of final demand of 1961. There were eight categories of final demand: Household consumption, Gross private capital formation, Net inventory change, Exports, Competitive imports, State and Local government, Federal government and Ordinance.

Modification of (2.20) gives,

$$z_t^g = (I-A)_t^{-1}\ y_{1961}^g - y_{1961}^g \qquad (2.25)$$
$$t = 1939,\ 1947,\ 1958$$
$$g = 1,\ 2,\ \ldots,\ 8$$

To calculate equation (2.25), all that was required was to force all columns but the gth of the final demand matrix to be equal to zero. This would yield intermediate inputs that would have been necessary in 1939, 1947 and 1958 to satisfy particular categories of final demand in 1961. Having calculated individual intermediate input requirements an index was constructed to reveal the relative changes. The index (I) is of the following form:

$$I = \frac{2\,|z_t^g - z_{t-1}^g|}{z_t^g + z_{t-1}^g} \quad [1] \qquad (2.26)$$

$t = 1939, 1947, 1958$

$g = 1, 2, \ldots, 8$

If intermediate inputs between years remained identical then the index will be zero. In general, it was found that the change in intermediate input requirements between 1939 - 1947 and 1947 - 1958 for each category of final demand were greater for chemicals and machinery than for food and textiles group.

In addition to the inquiries listed above, Carter treated the changes in primary factor input requirements for the aforementioned years in a detailed fashion. However, the particular objective associated with this task is quite different from that of this thesis and, therefore, not addressed here.

As for particular similarities between Carter's and this project, it is perhaps the attempt to capture structural change through the use of the inverse matrices for different years. In this study, the use of 1961 and 1966 inverse matrices (or, impact matrices as referred to in this study) are made to examine the gross output levels in order to satisfy 1966 and 1971 final demand requirements respectively.

Staglin and Wessels [31] examined structural changes in the German economy between 1954 and 1958 and 1958 and 1962. Three compatible tables (56 x 56) for the Federal Republic of Germany were

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1. This formula is mentioned in [5:215] and, is somewhat different than that mentioned in [6:47].

available for the years 1954, 1958 and 1962. All input-output tables were adjusted to the 1962 price level. The central idea here is focused around two comparisons - changes in intermediate input requirements due to changes in inverse coefficients and, changes in gross output due to changes in final demand and inverse coefficients between 1954 and 1958 and 1958 and 1962. Let us denote intermediate input, gross output and final demand as z, X and y respectively. Then, it is correct to write,

$$z = (I-A)^{-1}\ y - y \qquad (2.27)$$

To represent structural change reflected in intermediate input requirements, Staglin and Wessels put forward the following idea:

$$z^{*}_{1954} = (I-A)^{-1}_{1954}\ y_{1962} - y_{1962} \qquad (2.28)$$

$$z^{*}_{1958} = (I-A)^{-1}_{1958}\ y_{1962} - y_{1962} \qquad (2.29)$$

and,

$$z_{1962} = (I-A)^{-1}_{1962}\ y_{1962} - y_{1962} \qquad (2.30)$$

Equation (2.30) is an identity and must hold. What are the implications of equations (2.28) and (2.29)? Equations (2.28) and (2.29) respectively represent those intermediate demand vectors which would have been necessary to satisfy 1962 final demand if 1954 and 1958 economic structure had prevailed in 1962. Differences between equations (2.28) and (2.30) yield the difference in intermediate demand between 1954 and 1962 due to change in inverse coefficients alone. Similarly the difference between equations (2.29) and (2.30) is the difference in intermediate demand due to change in inverse coefficients between 1958 and 1962. Equations (2.28), (2.29) and (2.30) were compared. To facilitate compatible comparison, percentage changes between the two four-year periods were calculated as:

$$\frac{z^*_{1958} - z^*_{1954}}{z^*_{1954}} \times 100 \text{ and } \frac{z_{1962} - z^*_{1958}}{z^*_{1958}} \times 100$$

It will be impossible to discuss the performances of all 56 sectors here. In general, it was found that for almost all sectors, intermediate inputs declined between 1954 through 1962. Agriculture, for example, showed a decline of 11.2 percent in intermediate input between 1954 to 1958 and 7.1 percent between 1958 and 1962.

The second aspect on structural changes is based upon separate differences in gross output due to final demand change and coefficient change. In other words,

$$(I-A)^{-1}_{1958}\, y_{1958} - (I-A)^{-1}_{1958}\, y_{1954}$$

represents changes in gross output due only to change in final demand. A very similar expression could be written for change in gross output due to change in final demand between 1958 and 1962. The change in gross output due to changing coefficients between 1954 and 1958 could be expressed as:

$$(I-A)^{-1}_{1958}\, y_{1954} - (I-A)^{-1}_{1954}\, y_{1954}$$

Again, a similar expression representing the change in gross output to changing coefficients exists between 1958 and 1962. Total final demand between 1954 to 1958 (in 1962 prices) had risen 37 percent. The increase in final demand caused the mean of total gross output for all sectors to rise by 36.4 percent between 1954 and 1958. It is needless to mention, that individual changes in each sector showed a great deal of variation. As for effects due to changing coefficients between 1954 and 1958 alone, the results for a majority of sectors showed a negative value, indicating that the particular sector in 1954 operating with 1958 structure could have satisfied 1954 final demand with less than actual production in 1954. As for Agriculture, forestry, and fishing, the results show that this sector in 1958 could have satisfied 1954 final demand by producing 613 percent less than actual 1954 gross output. This particular industry in 1962 could have met 1958 final demand with 4.8 percent less than actual 1958 gross output.

Finally, we will very briefly mention a study by Vaccara [38] which investigated structural changes in the United States between 1947, 1958 and 1961. It should be made clear at the outset that, this particular study is not significantly different from that of Carter and Staglin and Wessels, already mentioned. Therefore, a detailed discussion concerning the entire methodology would be repetitious and will be omitted. This study is based upon input-output tables of order 81 x 81. All tables [1947, 1958, 1961] were brought to the 1958 price level. Vaccara examined the intermediate input requirements in 1958 to deliver 1958 final demand with 1947, 1958 and 1961 structural matrices. This could easily be performed following the basic methodology presented in (2.20) or (2.23) through (2.30). Comparison of results on intermediate input requirements between Vaccara and Carter is not possible because of different price levels (1958 and 1947). General comparison indicated that insofar as total intermediate inputs were concerned, intermediate input requirements were highest with the 1947 inverse and lowest with the 1961 inverse for delivering 1958 final demand. But what is more important is that, the directions of change in the intermediate input requirements for the two time periods, followed a consistent pattern.

Of the 36 industries that revealed positive increases between 1947 and 1958, 26 revealed positive increases between 1958 and 1961. Of the 35 industries that showed decline in requirements between 1947 and 1958, 22 again showed decline between 1958 and 1961.

Vaccara introduced another method. Intermediate inputs necessary to produce 1958 gross output based upon 1947, 1958 and 1961 direct coefficients were calculated.

In other words,

$$z_t = A_t X_{1958} \qquad (2.31)$$

$$t = 1947,\ 1958,\ 1961$$

where z, A and X are intermediate input vector, matrix of input-output coefficients and gross output respectively. The multiplication on the right-hand-side of (2.31) yields intermediate inputs required for each industry to produce the 1958 output level with 1947, 1958 and 1961 structural matrices. On average, industries showed similar pattern in changes respecting inverse and direct coefficients. However, within industries, differences were significant supporting the points stated earlier with regard to the different types of structural change that are captured through inverse coefficients as opposed to direct input coefficients.

CHAPTER III

THE RECTANGULAR INPUT-OUTPUT MODEL

Since this thesis is based upon a commodity-industy system rather than a more familiar inter-industry system, a thorough discussion of the particular rectangular model used in this study will facilitate understanding of the mathematical scheme discussed later.

Firstly, the discussion will be specific to the particular merits of a rectangular system. Secondly, the accountng framework of the system used here will be discussed. Thirdly, we will consider the general rectangular model as developed by Statistics Canada [35].

The Inter-Industry Versus Commodity-Industry System

While considering the input-output analysis the first thing that comes to mind is an inter-industry analysis. This innovation of Professor Leontief has had a tenacious period of success. Along with the recognition that input-output analysis has attained, weaknesses have been pointed out at the same time. Since the name, input-output analysis, readily triggers a thought which immediately suggests a square system, it may be emphasized that rectangular input-output systems have now been developed and are in operation. The following observations of Rosenbluth [28] bring out certain merits of a rectangular model in comparison to an inter-industry system.

Firstly, apart from the assumptions of constant return to scale and no joint products, the assumption of fixed coefficients appears to be the chief weakness of an input-output model. Although the input coefficients of an inter-industry model are supposed to represent the absorption of input per unit output, these coefficients, do not always clearly represent this information. For example, the agriculture implement industry as its input, may absorb a certain amount of processed material from the steel industry for production of tractors. This particular input is properly accounted for by the implement industry. But, what about the parts purchased for the maintenance of the machineries required in the production process of the tractors? In most cases, we will find that this purchase may be considered as an expense but not likely as an input for the production of tractors. It will now be justified to remark that in an inter-industry analysis, the technical coefficient may not truly represent the inputs required in a production process. A commodity-industry system however, explicitly allows for this type of inputs.

Secondly, the inherent assumption of fixed coefficients holds true in a very robust manner in a commodity-industry analysis as opposed to inter-industry analysis. The reason for this is that it is commodities that are really used by industries for production of other commodities.

Thirdly, while in a square system there is explicit mention of input coefficients, emphasis has not been given on output coefficients which is a function of input coefficients.

Fourthly, a square system is usually a crude aggregated version of a rectangular system. The point here is that if the industries are aggregated according to homogeneity of the product, there will be, due to statistical difficulties, some commodities which are produced in more than one industry, irrespective of the degree of precision observed in the statistical procedure. Conversely, if industries are to be aggregated on the basis that each individual commodity is produced in only one aggregated industry then this can be achieved at a greater heterogeneity of industry output.

The Accounting Framework

We proceed now to the discussion of accounting framework of the input-output system of this study. Before proceeding to the specific discussion, few points must be considered. First, the accounting framework of the model used here is identical to that followed by Statistics Canada [35]. Second, the discussion on the accounting framework is directly from Statistics Canada [35] and, therefore, may be considered inappropriate. However, this discussion could only be avoided if it is assumed that the reader is perfectly familiar with the framework used by Statistics Canada. Since rectangular systems are still not common, it was felt that a very brief description of the accounting framework and the model of Statistics Canada [35] was necessary. An absolute minimum treatment of the accounting system is considered here and, a complete discussion is left to the reader.

The basic accounting system, is based upon two sets of accounts - the commodity accounts and the industry accounts. The system is rectangular because the number of commodities exceeds the number of industries. A schematic diagram of the accounting framework is given in Table 3.1. Among all the matrices associated with the commodity accounts, U, I and YI represent inputs to industries. Matrices U and I depict the values of intermediate inputs of commodities to industries for production of commodities. Primary inputs are shown in YI. Matrices U and I exclude sales and or excise taxes. On the industry accounts side, matrix V depicts the values of production of each commodity produced by each industry, valued at producers' prices. For example,

Table 3.1

	Commodities	Industries	Final Demand Categories: Personal Expenditure	Fixed Capital Formation	Inventory Withdrawals	Inventory Additions	Gross Government Current Expenditure	Export	Less Import	Less Government Revenue	Total
Commodities		U				F					q
Industries	V										g
Unallocated Imports & Exports Non-competing Imports		I				I*					
Indirect Taxes Labor Income Net Income Unincorporated Bus. Other Operating Surplus		YI				YF					n
Total	q*(=q)	g*(=g)				e*					

NOTE: q is a vector of the values of total commodity outputs;
g is a vector of the values of total industry outputs;
U is a matrix of the values of intermediate inputs;
V is a matrix of the values of industry outputs;
F is a matrix of the values of commodity inputs of final demand categories;
YF is a matrix of the values of primary inputs of final demand categories;
I is a matrix of the values of inputs of industries;
YI is a matrix of the values of primary inputs of industries;
e* is a vector of the values of total inputs of final demand categories;
n is a vector of the values of total primary inputs (industries plus final demand);
I* is a matrix of the values of inputs to the final demand.

Source: [35:13]

if we read across the row: Agriculture industry of the matrix V then, this row will depict the values of various commodities like Cattle and Calves, Hogs, Poultry etc. produced by this industry. Similarly, a particular column in the matrix V depicts the values of this commodity produced by each industry. All margins such as transportation, retail or wholesale are treated as separate inputs to industries. In addition to the matrices mentioned already, F, I* and YF are matrices associated with commodity accounts. Values of intermediate inputs to final demand are depicted in matrices F and I*, whereas, YF depicts the values of primary inputs to final demand. It must be clear that the value (q) of a commodity used as an intermediate input by industries plus final demand sectors must equal the value (q*) produced by the industries. Conversely, the values (g*)of commodities absorbed as inputs by an industry must equal the values of commodities (g) produced by this industry. Total supply of commodities are met through domestic production and also imports, government production and inventory withdrawals - the latter three belonging to final demand.

At this point, it might be appropriate to point out that as for final demand matrix, mostly aggregated sectors are shown in Table 3.1. In this project, there were 14 sectors of final demand:

1. Consumer expenditure, durable. 2. Consumer expenditure, semi-durable. 3. Consumer expenditure, non-durable. 4. Consumer expenditure, services. 5. Construction, business. 6. Construction, Government. 7. Machinery and equipment, business. 8. Machinery and equipment, government. 9. Net change in inventories. 10. Domestic exports. 11. Re-exports. 12. Imports. 13. Gross government current expenditure. 14. Government revenue from the sale of goods and services. Appendix

B depicts a complete disaggregation of final demand categories that constitute these 14 sub-categories.

The value of production, as opposed to shipments is considered as the output of an industry because shipments are sometimes tied to inventory withdrawals. All actual used inputs are treated as inputs only. Inputs that are not explicitly accounted for and, outputs of industries that do not have primary products are, treated in a catch-all scheme as dummy commodities and dummy industries respectively. Appendix B accounts for all dummy commodities and dummy industries.

The Output Determination Model

The discussion here is specific to the model developed by Statistics Canada [35]. Since the framework of this study is based upon this model, it is imperative that this model first be understood. It should be perfectly clear that equations (3.1) through (3.10) are cited in [35:31-32].

Assumptions of the Model

There are two basic assumptions. The first assumption is known as the domestic market share assumption which suggests that each industry produces commodities in fixed proportions. This proportion may be derived easily if each cell in the column of output matrix V is divided by the corresponding total commodity output. This first assumption can be expressed as follows:

$$g = Dq \qquad (3.1)$$

where g is a vector of the values of total industry outputs, D is a matrix of coefficients obtained by dividing each element in a column of matrix V by the corresponding total commodity output and q is a vector of the values of total commodity outputs produced domestically. Matrix D is referred to as the Domestic Market Share Matrix.

The second assumption is known as the industry technology assumption. This assumption suggests that the inputs of a production process are fixed for each industry. These inputs are obtained by dividing each column of input matrix U by the corresponding total industry output. Mathematically,

$$Ui = Bg \qquad (3.2)$$

where i is a column vector whose elements equal unity, B is a matrix of coefficients which is obtained by dividing each element in a column of U by the corresponding total industry output and g is the vector of the values of industry outputs. Matrix B is referred to as the Industry Technology Matrix.

The equation that balances the supply and disposition of each commodity is as follows:

$$q + m + a + v = Ui + e + x \qquad (3.3)$$

where m is a vector of the values of commodity imports, a is a vector of the values of goverment production, v is a vector of the values of withdrawals from inventory and e is a vector of the values consisting of the following final demand categories:
Consumer expenditure - durable, semi-durable, non-durable, services + Construction - business, government + Machinery and equipment - government, business + Additions to inventory + Gross government current expenditure. Since Ui = Bg, (3.3) could be wirtten as:

$$q = Bg + e + x - m - a - v \qquad (3.4)$$

Substitution of (3.4) in (3.1) yields,

$$g = D\ (Bg + e + x - m - a - v)$$

$$= DBg + D\ (e + x - m - a - v)$$

$$= (I - DB)^{-1}\ D(e + x - m - a - v) \qquad (3.5)$$

equation(3.5) yields industry output without allowing for leakage - imports, inventory withdrawals and government production of goods and services. Since supply and disposition must always be equal and since domestic supply ay also be met through imports, inventory withdrawals and government production, these leakages ought to be taken in to consideration in (3.5). Equations (3.6) through (3.8) describe leakage coefficients

$$m = \mu(Bg + e) \qquad (3.6)$$

where m, as before, is the import vector, is a diagonal coefficient matrix calculated as a ratio of imports to use, use defined as Bg + e.

$$v = \beta(Bg + e + x) \qquad (3.7)$$

v is a vector of withdrawals from inventories, is a diagonal matrix of coefficients calculated as the ratio of withdrawals to use, use defined as Bg + e + x.

$$a = \alpha(Bg + e + x) \qquad (3.8)$$

where a is a vector of government production of goods and services, is a diagonal matrix of coefficients calculated as the ratio of government production to use, use defined as Bg + e + x.

Substitution of (3.6), (3.7) and (3.8) in (3.4) gives,

$$q = (Bg + e + x) - \mu(bg + e) - \alpha(Bg + e + x) - \beta(Bg + e + x)$$

$$= (I - \mu - \alpha - \beta)\ Bg + (I - \mu - \alpha - \beta)\ e + (I - \alpha - \beta)\ x \qquad (3.9)$$

where I is an identity matrix complying with the dimensions of the coefficient matrices. Substitution of (3.9) in (3.1) gives,

$$g = D(I - \mu - \alpha - \beta)\ Bg + D((I - \mu - \alpha - \beta)\ e + (I - \alpha - \beta)x)$$
$$= (I - D(I - \mu - \alpha - \beta)B)^{-1}D((I - \mu - \alpha - \beta)\ e + (I - \alpha - \beta)x) \tag{3.10}$$

where $(I - D(I - \mu - \alpha - \beta)B)^{-1}D$ defines an Impact matrix and the remaining part in (3.9) defines final demand adjusted for leakages. The impact matrix is rectangular with industries down the rows and commodities across the columns. The impact matrix displays the impact of each dollar increase in final demand of a commodity upon industry output. If two commodities, for example, are produced by one industry alone, then the impact coefficients of these two comcomdities remain the same on all industries. This point arises from the treatment of the D matrix.

For completness, we point out that $(I - D(I - \mu - \alpha - \beta)B)^{-1}$ represents a Leontief inverse. This matrix will indeed depict the interdependence between industries, and it should be recognized that this particular matrix is a common feature between the classical and the rectangular model. Multiplication of this matrix by the D matrix (Market Share) brings out the interdependence between industries and commodities. Every column of a Leontief inverse depicts the necessitated change in output of every industry due to a rise in final demand in a particular industry by one dollar. On the other hand, each column of an impact matrix of the rectangular model depicts the necessitated change in output of every industrydue to a rise in final demand of a commodity by one dollar. The sum of a column of the impact matrix, therefore, is the final demand multiplier associated with the particular commodity.

Distinction Between the Keynesian and the Input-Output Multiplier

Finally, it should be pointed out that the final demand multiplier and the Keynesian investment multiplier are complementary [16:22]. Consider a simple Keynesian model:

$$Y = C + I \tag{3.11}$$

$$C = aY \tag{3.12}$$

Where C is aggregated consumption expenditure, Y is aggregate income, I is aggregated domestic private investment and a is the marginal propensity to consume. Substitution of (3.12) in (3.11) gives,

$$Y = aY + I \tag{3.13}$$

The investment multiplier is the change in income divided by the change in investment. In other words, the multiplier is [37:12]:

$$\frac{\partial Y}{\partial I} = \frac{1}{(1-a)} \tag{3.14}$$

The multiplier represents the effect on income due to increased expenditure. The larger the marginal propensity to consume, the larger will be the multiplier. Furthermore, the multiplier is nothing but the sum of the following power series:

$$1 + a + a^2 + a^3 + \ldots$$

As income rises, there will be a corresponding rise (measured by the marginal propensity to consume) in consumption. This consumption spending will stimulate production which will cause a further rise in income and so on. This process stops until a new equilibrium is reached where planned saving equals planned investment.

In the input-output model, the multiplier represents the once for all increase in gross output due to a one dollar rise in final demand. Furthermore, in an open input-output model, as is the case here, both labour income and final demand expenditure sectors are exogenous and hence the effect of a change in final demand expenditure upon the labour income sector is not given by the multiplier [16:22].

CHAPTER IV

THE METHODOLOGY

In Chapter III we discussed the general output determination model which acts as the basis for the particular framework of this thesis. It was also mentioned that the impact matrix will play an important role in this thesis. With the general rectangular model in mind, we proceed to discuss the framework and the methodology. It was mentioned in Chapter I that, the objective of this thesis is threefold. The first objective is that of forecasting industry outputs for 1980 based upon the structural or impact matrix of 1971. Secondly, the change in input requirements, both intermediate and primary, between 1961 to 1966 and 1966 to 1971 are explored. Thirdly, the effects upon industry output vector g due to changing coefficients in impact matrices between 1961 to 1966 and 1966 to 1971 are captured. The general output determination model is used throughout to arrive at the particular framework of this thesis. The methodology used in this study is described below.

(a) <u>Forecasting Industry Outputs for 1980</u>

<u>Assumptions</u>

There are three assumptions necessary here to forecast industry outputs. First, it is assumed that the impact matrix of 1971 will remain stable in 1980. Second, since it was necessary to forecast final demand first in order to forecast gross output vector, the forecasted vector of final demand for 1980 is assumed to be realized. Third, all leakage coefficients for 1971 are assumed to remain stable through 1980.

Mathematically the industry output vector can be expressed as:

$$g^*_{1980} = I_{1971}\ FD^*_{1980} \qquad (4.1)$$

where g^*_{1980} is the forecasted vector of industry output in 1980 based upon the impact matrix of 1971, I_{1971} is the impact matrix of 1971 and FD^*_{1980} is the forecasted vector of 1980 final demand adjusted for leakages with 1971 coefficients. The symbols I and FD have merely been used to avoid long expressions as in (3.10). There are two projected output vectors for 1980. The first is due to an estimated 1980 final demand based upon final demand of 1961, 1966 and 1971. The second is due to an estimated final demand of 1980 based upon final demand of 1966 and 1971. In order to arrive at the final demand for 1980 the following steps are taken.

First, the final demand vector for 1980 is projected based upon extrapolation, where final demand between 1971 and 1980 is assumed to grow at a rate which equals the average of percentage changes between 1961 to 1966 and 1966 to 1971. The following method is adopted to forecast the final demand for 1980.

$$FD^*_{1980} = FD_{1971}[1 + 9\ [\frac{\frac{FD_{1966} - FD_{1961}}{FD_{1961}} \div 5 + \frac{FD_{1971} - FD_{1966}}{FD_{1966}} \div 5}{2}]] \qquad (4.2)$$

where FD^*_{1980} is an estimate of final demand vector of 1980 with 1971 leakage coefficients. The reason for using 1971 leakage coefficients will be discussed below. The vectors FD_{1961}, FD_{1966} and FD_{1971}, as before, denote final demand for the years 1961, 1966 and 1971. Equation (4.2) considers the simplest index of change in final demand calculated as the difference between two points. The final demand for 1980 is assumed to grow at a constant rate. This assumption of linearity enables us to multiply the average growth rate by the number of years and arrive at the projected value. More expicitly, it is assumed that the average annual growth between 1961 to 1966 and 1966 to 1971 will indeed remain constant until 1980.

Second, the final demand for 1980 is projected on the basis of final demand of 1966 and 1971. Mathematically this procedure takes the following form:

$$FD^*_{1980} = FD_{1971}\ [1 + 9[\frac{FD_{1971} - FD_{1966}}{FD_{1966}} \div 5]] \qquad (4.3)$$

where FD^*_{1980} is the projected vector of final demand for 1980 with 1971 leakage coefficients. This projection is based upon the annual percentage change in final demand which existed between 1966 and 1971. The only difference that separates the two procedures is that, in (4.2) the average annual growth in final demand between two five year periods is considered, where as, (4.3) is specific to the average annual growth in final demand in a single five year period. Linearity assumptions are maintained in both situations.

Third, each estimate of final demand is substituted in (4.1), to obtain two different gross output vectors (g^*_{1980}) for 1980. These forecasts are based upon the 1971 impact matrix. The impact matrix of 1971 represents the economic structure of that year and, therefore, for the forecasts to be realized it is important that the economic structure of the Canadian economy in 1980 does not differ significantly from 1971.

As for projecting final demand, the method adopted here under-estimates the projection because of the linearity assumption. An alternate method to estimate FD^*_{1980} as in (4.2) and (4.3) would respectively be,

$$FD^*_{1980} = FD_{1971}\ [1 + [\frac{\frac{FD_{1966} - FD_{1961}}{FD_{1961}} \div 5 + \frac{FD_{1971} - FD_{1966}}{FD_{1966}} \div 5}{2}]]^9 \qquad (4.4)$$

and,

$$FD^*_{1980} = FD_{1971}\ [1 + (\frac{FD_{1971} - FD_{1966}}{FD_{1966}} \div 5)]^9 \qquad (4.5)$$

Equation (4.4) still calls for an average annual growth rate between 1961 to 1966 and 1966 to 1971, and equation (4.5) is based upon an average annual growth between 1966 and 1971. The main point in (4.4) and (4.5) is that we are speaking of an increase which is no longer taking place at a constant rate but, at a compounded rate. In addition, equations (4.2) and (4.3) will give rise to estimates of final demand vectors lower than those obtained from (4.4) and (4.5). However, projections based upon (4.4) and (4.5) were not calculated.

As for calculating FD^*_{1980}, identical elements in the columns of final demand matrices for respective years were treated to find percentage change between years. It was mentioned that each projected vector of final demand was adjusted by 1971 leakage coefficients for imports, inventory withdrawals and government production. We recall that to calculate leakage coefficients from (3.6), (3.7) and (3.8) as a share of total use, use is defined as $Bg + e$ and $Bg + e + x$. Now suppose we wish to project leakage coefficients due to imports, there remain two unknowns - the coefficient matrix B and the output vector g. As for the vector g, it is this particular vector that we wish to forecast. Insofar as projecting matrix B is concerned, we need the vector g to calculate this matrix. One solution might be to calculate import leakage coefficients based upon B and g both for 1971. But would this calculation be theoretically correct? The answer is no, because we would calculate import leakage coefficients for 1980 based upon the use of commodities of 1971. It is true that projected final demand for 1980 with 1971 leakage coefficients introduces some bias. However, it is assumed that all leakage coefficients will remain stable.

A final remark is that all matrices, as depicted in Table 3.1, for the years 1966 and 1971 were deflated to 1961 price level. A common base year price level allows us to compare each industry's output in 1961, 1966, 1971 and 1980. In Chapter V, a complete discussion on the deflation of the matrices is considered.

(b) The change in input structure.

It was explained that B is a matrix of coefficients which is calculated from the matrix U, which is a matrix of intermediate commodity inputs required by industries for production of other commodities. Now consider the matrices U, I and YI (from Table 3.1) which include both intermediate and primary inputs. Let us consider a matrix U* which is a matrix that considers all inputs depicted in U, I and YI. In other words, U* is no longer augmented. The first set of rows in U* depict all intermediate commodity inputs, the second set depicts the inputs of Unallocated Imports and Exports and Non-Competitive Imports and, the third set of rows depict all primary inputs. All inputs here are absorbed by industries which extend across the columns. Now can be measure the changes in input structure between 1961 to 1966 and 1966 to 1971? The answer is yes, if such changes are calculated for a common base year price level. To calculate the changes in input structure, the following steps were taken.

First, a matrix of coefficients B* was calculated from matrix U* based upon the same procedure as B. In other words, each element in a column of U* was divided by the corresponding industry input which also equals output. It is needless to say, this was carried out for all three years - 1961, 1966 and 1971.

Second, an index of relative change was calculated based upon the following formulae:

$$\frac{B_{ij}^{*1966} - B_{ij}^{*1961}}{B_{ij}^{*1961}} \times 100 \text{ and } \frac{B_{ij}^{*1971} - B_{ij}^{*1966}}{B_{ij}^{*1966}} \times 100.$$

The first expression denotes the change in inputs between 1961 and 1966 and, the second expression denotes the change in inputs between 1966 and 1971. The above formulae give rise to two matrices depicting percentage change in inputs between two five year periods: 1961-1966 and 1966-1971. These matrices have commodities and primary inputs down the rows and industries across the columns.

(c) Impact of structural change

Thus far we have discussed the first two aspects of the thesis. We shall consider the third aspect here. The main thrust here lies in examining the effect of changing impact matrix coefficients upon gross output. Two identical questions are raised with regards to structural changes between 1961 to 1966 and 1966 to 1971. Firstly, we ask the following question: what would have been the individual industry output in 1966 if final demand of 1966 had to be satisfied with 1961 impact matrix? Secondly, we examine the industry output vector in 1971 if final demand of 1971 had to be satisfied with 1966 impact matrix. If impact coefficients had changed between 1961 and 1966 then, the actual output vector in 1966 will be different from the output vector produced with the 1961 impact matrix to satisfy 1966 final demand if all computations are carried out in a common price level. As mentioned, this particular change in output, due to change in the impact matrix, is a measure of structural change between 1961 and 1966. If 1971 final demand is held constant, structural change between 1966 and 1971 can be measured in a similar manner. To capture the impact of structural change between 1961 and 1966, the following procedure was employed.

First, all matrices for 1966 were deflated to 1961 price level. The output vector for 1966 was calculated as follows:

$$g_{1966} = I_{1966} \, FD_{1966} \qquad (4.6)$$

where g_{1966}, I_{1966} and FD_{1966} is the industry output vector, impact matrix and final demand matrix respectively in 1961 dollars.

Second, the impact matrix of 1961 was multiplied by the final demand vector of 1966 to yield a gross output vector for 1966.

$$g^*_{1966} = I_{1961} \, FD_{1966} \qquad (4.7)$$

where g^*_{1966} is the output vector which would have been produced in 1961 with the 1961 impact matrix I_{1961}. The output vector g is denoted by a star (*) to distinguish from the actual output vector in 1966.

Third, an index to measure structural change between 1961 and 1966 is calculated as follows:

$$\frac{g^*_{1966} - g_{1966}}{g_{1966}} \times 100$$

It should be clear that the numerator of this expression stems from the following equation:

$$g^*_{1966} - g_{1966} = (I_{1961} - I_{1966})\ FD_{1966} \tag{4.8}$$

where the left hand side will equal zero if the inpact coefficients for each year are equal.

In addition to deflating all 1971 matrices to 1961 prices, structural changes between 1966 and 1971 are measured through the following steps.

First, the output vector for 1971 in 1961 prices is calculated as follows:

$$g_{1971} = I_{1971}\ FD_{1971} \tag{4.9}$$

Second, an output vector which would have been produced in 1971 with 1966 economic structure to satisfy 1971 final demand was calculated through equation (4.10).

$$g^*_{1971} = I_{1966}\ FD_{1971} \tag{4.10}$$

Third, an index was calculated to measure structural change between 1966 and 1971 using the following expression:

$$\frac{g^*_{1971} - g_{1971}}{g_{1971}} \times 100$$

It is needless to mention, if the impact coefficients between 1966 and 1977 are equal, then the numerator of the above expression is zero.

CHAPTER V

THE DATA STRUCTURE

The thesis, as has been mentioned, consists of three aggregated input-output tables which (though aggregated) represent the entire Canadian economy for the years - 1961, 1966 and 1971 with the main focus being agricultural industries and commodities. The discussion will first be concerned with the U and V matrices. The final demand matrix will be discussed later. Statistics Canada, at the most detailed level, prepares input-output tables with 191 industries, 595 commodities and 7 primary inputs. The U matrix, at the most detailed level, has 191 industries and 593 commodities excluding unallocated imports and exports, and noncompeting imports. Similarly, the V matrix, at the most detailed level, has 191 industries and 593 commodities. This level of aggregation is referred to as Large or L [35:33-47]. Due to data confidentiality under the provisions of Statistics Act, matrices at this level are not published. Publications are made available by Statistics Canada at different levels of aggregation known as M or Medium and S or Small [35]. The U and V matrices at the Medium level (M) have 43 industries and 92 commodities. At the Small level (S), these matrices (U and V) represent 49 commodities and 16 industries. The 7 primary inputs at the Large level are aggregated (4) for Medium and Small levels. The levels of aggregation are hierarchial. The Medium aggregation can be derived from the Large level and the Small from the Medium level. Due to this hierarchial level of aggregation, full information is depicted in an input-output table at any level of aggregation.

The data contained herein includes 35 industries, 134 commodities and 4 primary inputs aggregated from 191 industries, 595 commodities and 7 primary inputs respectively. This particular level of aggregation is not published. This aggregation level differs from the published levels in that here the aggregation is carried with an emphasis on the Agricultural sectors - for both industries and commodities.

The author claims no credit in the aggregation procedure for the data were made available by Agriculture Canada. It should be pointed out however, that firstly it was the author's responsibility to trace through each commodity and industry in the analysis and distinguish among aggregated and non-aggregated commodities and industries. Secondly, care was taken to ensure that the total of all disaggregated commodities (including primary inputs) and industries are 602 and 191 respectively. Thirdly, it was verified that no double aggregation occurred either for a commodity or an industry. These steps were carried out by recognizing the fact that most aggregated commodities and industries correspond to the Small level of aggregation (S) of Statistics Canada [35].

The final demand matrix shows inputs of 134 commodities and 4 aggregated primary inputs for 14 aggregated categories of final demand. The 14 categories, discussed in Chapter III, are aggregated from 136 categories. A complete list of commodities and industries used in this study is cited in Appendix B.

Reorganization of the data base

An extensive amount of work was necessary to reorganize the data base before it could be put to use in the analysis. The original data base had commodities in an ad hoc manner. In other words, the ordering of commodities following one another was not homogeneous. For example, Forestry Products, Fishing and Trapping products were followed by Metallic Ores and Concentrates. Although such an ordering of com-comdities does not hide any necessary information represented in a matrix, a homogeneous ordering is more convenient when dealing with numerous commodities of different groupings which is the case here. The same argument holds true for industries. It was necessary to renumber each sector and reorganize the matrices according to a homogeneous arrangements of both commodities and industries.

Deflation Procedure

It was mentioned earlier that all tables for 1966 and 1971 were deflated to the 1961 price level. This facilitates compatible comparison of empirical results. In order to deflate 1966 and 1971 tables to 1961 price level, 138 appropriate commodity price indices were collected. These indices are cited Appendix C. Due to unavailability of a particular price index, the same price index has been used for one or more commodities. For example, the index for Animals was used to deflate Cattle and Claves, Other live animals, Sheep and Lambs, and Hogs.

For commodities, there is one to one correspondence between the columns of the V matrix, rows of the U matrix and the rows of the final demand matrix. In other words, if Hogs is the third column in the V matrix, then it is also the third row of the final demand matrix and the third row in the U matrix. Similarly for primary inputs, there is a correspondence in the rows of the inputs to industries and the and the rows of the inputs of final demand matrix. Therefore, it is correct to deflate the ith column of the V matrix, the ith row of the U matrix and the ith row of the final demand matrix by the ith price index. To deflate the primary inputs, a similar operation is necessary for the identical rows of YI and YF matrices of Table 3.1. To deflate a typical element U_{ij}^{1966} in the U matrix of 1966 to the 1961 price level, U_{ij}^{1966} ought to be multiplied by Pi^{1961}/Pi^{1966}; where Pi^{1961} and Pi^{1966} respectively represent the price index (1961 = 100) of commodity input i of 1961 and 1966. Similarly, to express the identical element for 1971 could be deflated as:

$$U_{ij}^{1971} \frac{Pi^{1961}}{Pi^{1971}}$$

where Pi^{1971} is the price index (1961 = 100) of commodity input i of 1971. The same argument holds true for deflating the V and the final demand matrices. Again, as for deflating the V matrix, each column represents a commodity and could be deflated column by column. It may be noted that if each row, of the matrix V, is deflated by an industry price index, this procedure introduces significant bias since this implies deflating the values of commodities across a row by a composite index - i.e. the index number of that industry which produces these commodities. For example, deflating the Agriculture industry row would imply using one index number for deflating both livestock and field crops. On the commodity side, however, distinction between index numbers are kept as livestock and field crops are deflated by different sets of index number.

Calculation procedure of leakage coefficients

For accounting purpose, imports, government production and inventory withdrawals are treated with negative signs. However, to calculate these leakage coefficients each value of leakages is treated with a positive sign. The reason for this is obvious, each coefficient ought to represent the ration of each leakage to its total use.

Dimension of Matrices

U, B	:	132 x 35
V, D	:	35 x 132
U*, B*	:	138 x 35
μ, α, β	:	132 x 132
Impact	:	35 x 132

CHAPTER VI

RESULTS AND DISCUSSION

Validation of the Model

A number of validity checks were made with the general output determination model presented in equation (3.10) to ensure that the data used and the computer algorithm are correct. Such tests were necessary prior to forecasting industry output, calculating industry outputs for examining structural change and computing changes in the input structure matrix.

First, each element in the row of the industry output matrix V was added to obtain the value of total industry output (g). It was now necessary to see that the value of each industry output always equals the value of the corresponding industry input (g*). Each element in the column of the industry input matrices U, I and YI were added to obtain total industry input. In each case, total industry output always equals total industry input for 1961, 1966 and 1971, ensuring that the calculated coefficient matrix B is correct. This particular test was performed in current dollar matrices. The results are shown in Table A of Appendix A.

Second, balances on the values of commodity inputs and outputs (in current dollars) were also checked. Each element in the column of matrix V was added to obtain total commodity output. On the input side, each element in the row of the industry input matrices U, I and Yi plus the final demand matrix F was added to obtain total commodity input. This check, at first, did not balance. Commodity input was less than the corresponding commodity output. After a number of checks, one particular column of the final demand matrix - Consumer expenditure, non-durable; was found to be wrong. This particular column accounts mainly for commodities of food and feed origin. Data for this particular column were made available by the Input-Output Division of Statistics Canada. After correcting for this error, commodity inputs in some cases were not identically equal to commodity outputs. The discrepancies were very small and were accepted.

Third, all matrices were deflated to the 1961 price level. Each industry output was calculated by summing each row of the output matrix V. These values are cited in Table B of Appendix A. Each impact matrix was now multiplied by the adjusted final demand vector to obtain gross output. The values were then compared to the values obtained from the output matrix V. These values, although they should be equal, were not, as we shall see later. It is believed that the discrepancy is due to the error in the final demand matrix. For all sectors, the discrepancies were very small, it was therefore assumed that the empirical results obtained for the analysis would not contain any significant bias.

Impact Matrix

Impact matrices for the years 1961, 1966 and 1971 were calculated in 1961 dollars. These matrices are cited in Tables 31 through 87 in Appendix A. The impact matrix discussion will be specific to 1971 only. If Tables 69 through 81 are read across the rows then the necessitated change in output for each industry due to increase in final demand for all commodities by one dollar can be found. On the other hand, if Tables 69 through 81 are read down the columns then the necessitated change in output for all industries due to a one dollar increase in final demand for a particular commodity can be found. It can be seen from Table 69 that for each dollar increase in final demand for Cattle and Calves, Sheep and Lambs, and Hogs, the Agriculture industry would have had to increase its output by $1.075 (1961 dollars). The reason that the impact coefficients for each of the commodities is numerically the same is due to the fact only the Agriculture industry produces each of these commodities. This particular result was expected and was mentioned as we discussed the mathematical framework of the impact matrix. An interesting point to note is that the impact coefficient for Poultry is $1.0749. The reason for this is, besides the Agriculture industry, Poultry processors also produce a small amount of Poultry in the system. This can be seen by studying the impact coefficient of Cattle and Calves, Sheep and Lambs, and Hogs for the fourth industry: Poultry processors. For each dollar increase in final demand of these aforementioned commodities, Poultry processors would have had to increase production by $0.0003 respectively. But the impact coefficient found in the intersection of Poultry processors and Poultry if $0.0005. The impact coefficients capture both - direct and indirect requirements necessary to meet the final demand. For example, the impact coefficient 0.0003 for Poultry processors due to Cattle and Calves, Sheep and Lambs, and Hogs is indeed an indirect coefficient because Poultry processors do not produce these commodities. However, the fact remains that for each million dollar increase in final demand of each of these commodities, there had to be an increase in the production of Poultry processors by $300.

Similarly, it is found that in 1971, for one dollar increase in final demand of Poultry - Fresh, frozen, chilled; and Poultry - canned, there had to be respective increases of $0.8413 and $1.0351 in gross output of Poultry processors. A similar argument holds true for all other coefficients in the impact matrix for any year.

A rather strong point for a commodity - industry system should now be brought to light. In this system, impact of a single commodity upon all industries can be quickly traced. If one was to concentrate on impact of commodities in an economy, a commodity - industry system, will indeed, be a better choice as opposed to a square system.

Multiplier Effect

It was mentioned that each coefficient in a column in an impact matrix depicts the necessitated change in gross output due to increase in final demand of a particular commodity by one dollar. It was further mentioned that if all impact coefficients of a particular column are added, the sum would indicate the total amount which would be necessary for the economy to produce for a rise in final demand of the particular commodity by one dollar. Multipliers for 1971 for all 132 commodities are depicted in Table C of Appendix A. It can be seen that the multiplier for Cattle and Calves, Sheep and Lambs, Other live animals and Hogs is 1.7755. In other words, for every dollar increase in final demand in each of these commodities, the gross output of the entire economy must rise by $1.77. Among agricultural commodities, the difference in multipliers among processed and unprocessed commodities can be seen from this table. For example, the multiplier for processed fluid milk is 2.5854, whereas, the multiplier for unprocessed milk is 1.7755. The difference is due to the indirect requirements of all processed commodities. Furthermore, most processed agricultural commodities yield a higher multiplier compared to manufactured goods belonging to chemical or manufacturing sector.

One last point should be made clear before proceeding to the next discussion. The multiplier for Rice, unmilled; appears to be zero. This is true because apart from wild rice no other rice is produced in Canada. As for wild rice, this variable is treated as a miscellaneous input to processors. As for Rice, unmilled; this commodity should ideally be treated as a non-competing import. However, it is claimed by the Input-Output Division of Statistics Canada that the amount of rice used as an input is so small that treating it as a competing commodity does not introduce any serious bias in the impact matrix.

Forecasting

There are two gross output vectors for 1980 - both in 1961 dollars. The forecast values in 1961 dollars are depicted in Table D of Appendix A. To compare the forecast values in relation to the past performance an index of annual percentage change in output is presented in Table E of Appendix A. This was done to see how each industry will be performing between 1971 and 1980 relative to the performance between 1961 and 1971. The percentage change between 1961 and 1971 and between 1971 and 1980 has been calculated on the same principle which has been followed so far. That is, the difference between the final value and the initial value is divided by the initial value. Bearing in mind that the percentage change per year between 1961 to 1971 is over a 10 year period as opposed to 9 years between 1971 to 1980, let us examine Table E. Let us refer to the forecasts based upon 1966 and 1971 final demand as first set of forecast or forecast 1, and that based upon 1961, 1966 and 1971 final demand as the second set of forecasts or forecast 2. Agriculture, on the basis of forecast 1, has a higher value than forecast 2. This indicates that the average growth rate of final demand between 1961 to 1966 raises the overall average growth rate of final demand over the two five-year periods,causing the projected final demand to rise correspondingly. This, in turn, raises the value of the industry output. It will be difficult, at this point, to claim which of the two forecasts is more realistic i.e. will come closer to the actual value. However, if we focus our attention upon column 1 and column 2 of Table E of Appendix A, remarkable similarities in performance over the former and the later decade for certain industries can be seen. Some of these industries are: Slaughtering and meat processors, Poultry processors, Fish products industry, Fruit and Vegetable processors and Biscuit manufacturers. However, it might be wrong to assume that statistically the projected values for these industries will lie within a narrower confidence interval as opposed to those which show lesser resemblance in performance between 1961 to 1971 and 1971 to 1980. The point to note is the similarities in performance r certain industries between the two decades. A particular industry forecast should now be discussed. Sugar refineries show a percentage change in output of 49.9 and 28 percent between 1971 to 1980, but between 1961 to 1971 it depicts a change of merely 2.38 percent. It was suspected this could be due to data errors and effort was made to trace through this particular industry. However, the forecast values were found to be correct. It is believed that the high forecast values could be due to the fact that Sugar refineries have a higher indirect requirement coefficient generated by various commodities. Now if the Sugar refineries row in the impact matrix of 1971 is examined closely then it can be seen that indirect coefficients for Sugar refineries are much higher for certain commodities, compared to another industry which is also not aggregated. An error in the calculation procedure for projecting final demand would effect all industries and hence this ground was rejected.

It will be difficult to comment on the projected values of Fishing, hunting and trapping, Mines, quarries and oil wells, Manufacturing except food, Electric power, gas and other utiltities and all other aggregated industries. It may be that if the output of one or more industries within the cluster turns out to be wrong then it will affect the aggregated industry output.

Change in input structure

All computations were carried out in 1961 dollars. Tables 1 through 15 in Appendix A depict the change in input structure between 1961 and 1966. Tables 16 through 30 depict the change in input structure between 1966 and 1971. To get an average change per year in a particular input the value in the table has to be divided by 5.

From Table 1 it is found that Agriculture, as its input, used

1.81 percent more of Cattle and Calves. At the same time, Agriculture decreased its input of Poultry, Wheat unmilled, Barley, oats, rye, corn and other grain, Oil seeds, nuts and kernels by 38.39, 25.01, 23.87 and 30.13 percent respectively. Input of Feed of animal origin (Table 2) increased by 141.32 percent. Input of Petroleum and coal products decreased by 18.79 percent, whereas that of Chemical and chemical products increased by 28.75 percent.

These changes depict the changes in input structure of various industries due to structural shifts. It is somewhat difficult to point out the particular reasons for each of these changes. Insofar as the objective of this study is concerned, it is the change itself that is of interest and not the cause of the change. To use Table 1 through 30 in an intelligent manner, a particular industry may be studied between the two five-year periods for changes in input structure. Labour income, for example, declined by 37.75 percent (Table 3) between 1961 and 1966, whereas the same input declined by 19.27 percent (Table 18) between 1966 and 1971. Indirect taxes fell by 113.68 percent (Table 3) between 1961 and 1966 and 197.64 percent (Table 18) between 1966 and 1971 for the Agriculture industry.

Comparison of input structure could be more useful if changes in another five year period, say 1971 - 1976 were available. This would enable us to follow the pattern of change over time.

It is beyond the scope of this chapter to accommodate discussion of every non-zero element of Table 1 through 30.

Structural change

Table F in Appendix A depicts industry output of 1966 and an output vector that would have been produced in 1966 with 1961 impact matrix to meet final demand of 1966. Similarly Table G depicts the actual industry output and an output vector which would have been produced in 1971 with 1966 impact matrix to meet final demand of 1971. All values are in 1961 prices. Before proceeding any further, a point should be clarified here. It was mentioned earlier that the values (1961 dollars) of industry output obtained by summing each row of the V matrix was compared to those obtained from the multiplication of the impact matrix and the final demand vector. It was also mentioned that these values were not identically equal. The industry output (obtained from the V matrix) for Agriculture depicted in Table B (Appendix A) is $4,065,613,000. However, the output (obtained from multiplication of the impact matrix and the final demand vector) for Agriculture in Table F is $4,064,800,000. As mentioned, the discrepancy is small and is believed to be due to the final demand matrix. However, for comparison of the actual 1966 output to the 1966 output with 1961 structure, the actual output obtained from the multiplication of the 1966 impact matrix by the 1966 demand vector is used. It can be seen from Table F that Agriculture would have had to produce 2.02 percent in excess of 1966 output if final deliveries of 1966 were to be met with 1961 impact matrix. But between 1966 and 1971, Agriculture in 1971 with 1966 impact matrix could have satisfied 1971 final demand by producing 4.05 percent less actual 1971 production. Two points should be clear. Firstly, changes in output here are due to changes in impact coefficients alone. Secondly, both direct and indirect coefficients are confounded in the analysis. If all industries are examined closely through results in Tables F and G then identical similarities are not found between the two five-year periods. Agriculture is an example of this. Forestry, on the other hand, would have to produce 20.46 and 18.33 percent in excess of 1966 and 1971 output respectively to meet 1966 and 1971 final demand with 1961 and 1966 impact matrix. Slaughtering and meat processing would have had to produce 8.01 percent in excess of 1966 output to meet final demand of 1966 with 1961 impact matrix. The same industry could have met the bill of goods of 1971 with 4.3 percent less production if 1966 structure had prevailed in 1971.

Poultry processors and Dairy factories show the same sign over both periods. As impact coefficients have changed over time the changes have affected each industry differently. Furthermore, changes in impact coefficients are due to direct and indirect requirements. Suppose Poultry processors slowly raise their share of Poultry production. As the amount of poultry required by the Miscellaneous food industries change, necessitated changes in output will be mostly captured by Agriculture and Poultry processors. But because of the increased share in Poultry processors of poultry production, the impact upon this industry would now be different. Among all 35 industries compared, Bakeries, Confectionery manufacturers, Sugar refineries, Vegetable oil mills and Miscellaneous food industries show consistent patterns of change. The first three industries would have had to produce 2.97, 2.97 and 1.05 percent in excess of 1966 output to meet 1966 final demand with 1961 impact matrix, and 0.55, 2.60 and 6.72 percent in excess of 1971 output to meet 1971 final demand with 1966 impact matrix. The last two industries on the other hand, could have met 1966 final demand with 1.48 and 4.22 percent less 1966 production if 1961 structure had prevailed in 1966. Both these industries could have satisfied 1971 final demand with 15.34 and 0.06 percent less 1971 production if impact matrix of 1966 was adopted in 1971. As for all other industries, the unpatterned behaviour between the two periods is indeed disconcerting. However, this particular pattern perhaps supports the point stated earlier with regard to measurement of structural change through inverse coefficients. It is never known whether it is direct or indirect coefficients that cause a particular change in pattern from one sector to another.

LIMITATIONS

One limitation is due to leakage coefficients of 1971 used in forecasting gross output of 1980.

Secondly, a discrepancy was found in the final demand matrix and this has introduced some bias. It is only hoped that the errors in the analysis due to this data problem, are of small magnitude. It may be pointed out that detecting errors from a matrix of dimension 138 x 14 is indeed a difficult task.

Third, and by far the strongest is that on the industry side, Agriculture is one completely aggregated sector. This aggregation distorts the impact matrix as well. Impact of various grains for example, remains the same. This particular limitation places a severe constraint on meaningful interpretation of the direct impact coefficients due to primary products of the Agriculture industry.

CONCLUSIONS

Firstly, impact matrices were discussed and calculated in 1961 prices. As mentioned, each column in these matrices depicts direct and indirect requirement of an industry due to a one dollar rise in final demand of a commodity. In Chapter III the correspondence between a Leontief inverse and an impact matrix was briefly mentioned. As the name suggests, this matrix displays the impact of a particular commodity upon an industry or industries.

From the commodity multipliers obtained from the column sum of the impact matrix, we saw the necessitated change in the entire economy due to each dollar increase in final demand for particular commodity. For commodity analysts, these multipliers could be regarded as an important source of information as repercussions of a particular commodity upon the economy is studied. At the same time, it may be pointed out that for commodities produced by only one industry, the empirical results for the multipliers are somewhat disconcerting. As mentioned, this particular characteristic stems from the market share assumption of the model. A clear distinction between processed and unprocessed commodities can be seen from the values of the multipliers. The reason that the values for the processed commodities are higher than that of unprocessed commodities is due to the indirect requirements necessary for the former group of commodities.

Industry outputs were projected for 1980 based upon two sets of forecasts of final demand for 1980. As in any other *ex ante* forecasting experiments, particular comments with regard to the forecast values are difficult to make. This is true to the extent that it is never known whether or not the particular forecast values will be realized. Therefore, percentage changes in real output were calculated between 1961 to 1971 and 1971 to 1980. The comparison suggests that similarities in performance between the two periods indeed exist for certain industries. As mentioned earlier, the similarities are easier to compare for a nonaggregated industry as opposed to a highly aggregated one. The reason for this is obvious. As one of the industries within the aggregated industry starts to behave differently then the entire forecast is distorted. It is certainly true that the higher the relative share of the industry within the aggregated industry, the higher the vulnerability of the forecast value.

Changes in input structure were examined between 1961 to 1966 and 1966 to 1971. Two important observations stem from these results. Firstly, the number of non-zero elements remains fairly constant between industries for the two periods. This indicates that 'new' inputs have not been tried. This suggests two things - either the accounting practice for keeping record of flows has not changed, or industries have, in general, maintained a consistent pattern of inputs between the two periods. Secondly, within the industry, sign of non-zero elements have either changed or the value itself has increased or decreased. Proliferation of new products dictates the method of use of other products. As time goes on, it is conceivable that input of a variable which declined from 1961 to 1966, increased in the 1966 - 1971 period because 'new' products required the use of this particular input. This would cause the signs of the input index to change. Furthermore, as structural shifts occur, the proportion of inputs no longer remains constant.

Finally, structural changes were explored through the gross output vector produced with each different year's structural matrix. If no change in structure had taken place then the value of the output vector produced with each different structural matrix would be the same if the final demand matrix was held constant. However, it was found that when the 1966 final demand vector remained fixed, the output (in 1961 prices) produced with the 1966 impact matrix is significantly different from the output that would have been produced with 1961 impact matrix. In other words, each industry, in 1966, would have to produce a level of output different from actual 1966 output to satisfy 1966 final demand if 1961 structure had prevailed in 1966. Similar results were found as the 1966 impact matrix was used for production of 1971 gross output to meet 1971 final demand. However, as for individual industries, many behaved differently between the two periods. An industry, which would have had to produce in excess of 1966 output if 1966 final deliveries were to be met with 1961 structure, could have met 1971 final demand with less than actual production if output was to be produced with 1966 pattern. Among all 35 industries compared, a group of 5 industries showed consistent pattern between 1961 - 1966 and 1966 - 1971 period. These were: Bakeries, Confectionery manufacturers, Sugar refineries, Vegetable oil mills and Miscellaneous food industries. It is difficult to point out the particular reason for similar pattern among these industries. It is believed that these industries are somewhat homogeneous and the pattern is interrelated. In addition, if indirect requirements were known then a more definite observation could be made. If indirect requirements show the same pattern between two periods for an industry, then it is indeed true that input requirements are consistent for a given vector of final demand. This, in turn, implies that more or less (depending on the pattern of indirect requirements) inputs are required, over time, to satisfy an identical vector of final demand.

The particular methodology employed here should serve as one of the first attempts with regard to forecasting and examining structural changes in the Canadian economy through a relatively 'new' rectangular input-output model. As mentioned, the study does have certain limitations. These limitations, it is hoped, can be overcome and other models developed based upon the framework presented here.

RECOMMENDATIONS FOR FUTURE RESEARCH

A few suggestions could be made with regard to future research. Firstly, if time series data were available for the final demand sector then a single equation econometric model may be built wherein each sector of final demand would be endogenous. For example, consumer expenditure sectors could be explained through past spending pattern and income. An *ex post* prediction could be made to see the stability of the model. If the model performs well then gross output could be forecasted for a future period.

Secondly, a methodology may be developed whereby the leakage coefficients for the base year could be projected for the year of the forecast.

Thirdly, structural change may be examined in light of indirect inputs as opposed to gross output. A number of studies have been discussed in this regard.

Fourthly, structural change may be examined through indirect inputs for a particular sector of final demand. In other words, actual indirect requirements due to a particular sector of final demand may be compared to a hypothetical vector of indirect requirements for a given year.

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APPENDIX A

The following tables are included in this appendix:

Current dollar industry outputs are depicted in Table A.

Constant dollar industry outputs are depicted in Table B.

Commodity multipliers are depicted in Table C.

Forecasts of industry output for 1980 are depicted in Table D.

Percentage change in output between 1961 and 1971, and 1971 and 1980 is depicted in Table E.

Actual and hypothetical output vectors of 1966 and 1971 are respectively depicted in Table F and Table G.

In addition to the tables mentioned above, Tables 1 through 15 depict changes in input structure between 1961 and 1966. Tables 16 through 30 depict changes in input structure between 1966 and 1971.

Tables 31 through 49, 50 through 68 and 69 through 87 depict impact matrices for the years 1961, 1966 and 1971 respectively in 1961 prices.

Table A

Total Industry Output in Current Dollars ($'000)

Industry	1961	1966	1971
1. Agriculture	2,843,825	4,736,694	4,923,733
2. Forestry	808,369	1,089,626	1,255,392
3. Slaughtering & Meat Processors	1,140,479	1,646,036	2,150,686
4. Poultry Processors	141,144	233,899	300,484
5. Dairy Factories	916,654	1,193,555	1,519,900
6. Fish Products Industry	187,558	310,593	400,905
7. Fruit & Veg. Processors	335,419	487,595	597,122
8. Feed Manufacturers	302,498	489.077	630,607
9. Flour & Breakfact Cereal Ind.	263,033	317,237	309,483
10. Biscuit Manufacturers	88,693	107,563	140,919
11. Bakeries	372,888	468,380	525,143
12. Confectionery Manufacturers	142,631	201,360	250,501
13. Sugar Refineries	131,961	143,724	224,652
14. Vegetable Oil Mills	63,884	102,214	137,844
15. Misc. Food Ind.	441,284	625,534	880,736
16. Soft Drinks Manufacturers	175,387	260,236	411,341
17. Distillers	176,760	275,672	401,688
18. Breweries	258,200	324,600	446,798
19. Wineries	18,545	27,941	58,695
20. Leaf Tobacco Processing	103,709	130,827	163,434
21. Tobacco Prod. Manufacturers	231,283	291,897	406,503
22. Fish'g, Hunt'g & Trapp'g	123,588	192,890	219,830
23. Mines, Quarries & Oil Wells	2,238,367	3,428,166	5,115,317
24. Manufacturing Except Food	19,188,208	31,803,648	43,316,096
25. Communications	1,099,196	1,709,509	2,776,822
26. Transp. & Storage	3,506,551	5,050,769	7,846,319
27. Elec. Power, Gas, Other Utilities	1,032,755	1,479,476	2,456,458
28. Wholesale Trade	2,529,464	4,134,676	5,941,969
29. Retail Trade	4,318,067	6,051,486	8,309,825
30. Fin., Ins., Real Estate	6,785,173	9,800,846	15,893,876
31. Community Bus., Personal Serv.	4,256,169	6,478,385	11,148,373
32. Transp. Margins	1,688,437	2,265,128	3,518,892
33. Construction	7,084,173	11,247,995	15,993,612
34. Oper. Office, Lab. & Food	2,598,963	4,529,755	6,557,807
35. Travel & Adver'g Promotion	1,409,287	2,264,929	3,389,875

Table B

Industry Output in 1961 Prices

Industry	1961	1966	1971	Growth 1961-1966	Growth per Annum	Growth 1966-1971	Growth per Annum
Agriculture	2,843,825	4,065,613	4,189,718	43.0	8.60	3.1	0.61
Forestry	808,369	980,025	1,009,225	21.2	4.25	3.0	0.99
Slaughtering and Meat Processors	1,140,479	1,444,369	1,576,207	26.6	5.33	9.1	1.82
Poultry Processors	141,144	174,297	226,371	23.5	4.70	29.9	9.95
Dairy Factories	916.654	1.059,591	1,162,102	15.5	3.12	9.7	3.22
Fish Products Industry	187,558	279,290	322,738	48.9	9.78	15.6	5.18
Fruit and Vegetable Processors	335,419	443,741	485,383	32.3	6.45	9.4	1.87
Feed Manufacturers	302,498	439,870	545,014	45.4	9.08	23.9	4.78
Flour and Breakfast Cereal Industry	263,033	285,307	252,236	8.4	1.70	-11.6	-2.31
Biscuit Manufacturers	88,693	96,574	110,126	8.9	1.77	14.0	2.80
Bakeries	372,888	421,139	422,790	12.9	2.58	0.4	.08
Confectionery Manufacturers	142,631	181,759	202,933	27.4	5.50	11.7	2.32
Sugar Refineries	131,961	154,570	163,388	17.1	3.43	5.7	1.14
Vegetable Oil Mills	63,884	94,182	115,966	47.4	9.48	23.1	4.62
Miscellaneous Food Industry	441,284	564,687	716,229	28.0	5.60	26.8	5.36
Soft Drinks Manufacturers	175,387	229,794	293,869	31.0	6.20	27.9	5.57
Distillers	176,760	248,001	323,432	40.3	8.06	30.4	6.08
Breweries	258,200	314,329	398,108	21.7	4.34	26.7	5.33
Wineries	18,545	28,629	54,653	54.4	10.87	90.9	18.18
Leaf Tobacco Processing	103,709	111,852	140,509	7.9	1.57	25.6	5.12
Tobacco Product Manufacturers	231,283	272,326	308,629	17.7	3.55	13.3	2.66
Fishing, Hunting and Trapping	123,588	173,470	176,979	40.4	8.07	2.0	0.40
Mines, Quarries and Oil Wells	2,238,367	3,064,858	4,093,022	36.9	7.38	33.5	6.70
Manufacturing Except Food	19,188,208	29,533,552	35,759,296	53.9	10.78	21.1	4.21
Communications	1,099,196	1,744,890	2,997,907	58.7	11.74	71.8	14.36

(Continued)

Table B (Continued)

Industry	1961	1966	1971	Growth 1961-1966	Growth per Annum	Growth 1966-1971	Growth per Annum
Transportation and Storage	3,506,551	4,706,415	6.045,215	34.2	6.84	28.4	5.68
Electric Power, Gas, and Other Utiltities	1,032,755	1,420,627	2,051,032	37.6	7.51	44.4	8.87
Wholesale Trade	2,529,464	3,699,422	4,778,575	46.3	9.25	29.2	5.83
Retail Trade	4,318,067	5,409,535	6,646,155	25.3	5.05	22.9	4.57
Finance, Insurance, Real Estate	6,785,173	8,908,525	12,030,619	31.3	6.25	35.0	7.01
Community Business, Personal Services	4,256,169	5,921,084	8,885,658	39.1	7.82	50.1	10.01
Construction	7,084,173	9,509,671	12,176,286	25.5	5.10	28.0	5.60
Operations Office, Lab and Food	2,598,963	4,044,423	5,280,037	55.6	11.12	30.6	6.11
Travel and Advertising Promotion	1,409,287	2,134,711	2,333,017	51.5	10.30	9.3	1.85
AVERAGE				31.85	6.37	23.8	4.76

Table C

Multipliers for 1971

(in 1961 dollars)

Cattle and Calves	1.7755
Sheep and Lambs	1.7755
Hogs	1.7755
Poultry	1.7755
Poultry, fresh, frozen, chilled	2.5039
Poultry,canned	2.6453
Other live animals	1.7755
Beef, Veal, Mutton, Pork-fresh & frozen	2.5331
Horse meat fresh, chilled, frozen	2.0432
Meat, cured	2.7237
Meat, prepared, cooked not canned	2.7235
Meat, prepared, canned	2.6092
Animal Oils and Fats and Lard	2.7179
Margarine, Shortening & like products	2.2228
Sausage casings, natural and synthethic	2.3841
Primary tankage	2.6453
Milk, whole, fluid, processed	2.5854
Milk, whole, fluid, unprocessed	1.7755
Fresh Cream	2.5853
Butter	2.5798
Cheese, Cheddar & Processed	2.5865
Milk Evaporated	2.5854
Ice Cream	2.5270
Other Dairy products	2.5808
Rice unmilled	0.0
Wheat,unmilled	1.7756
Barley, Oats, Rye, Corn, Grain Not elsewhere specified (NES)	1.7761
Wheat flour	2.3542
Fruits, fresh, except tropical	1.7764
Vegetables, fresh	1.7772
Vegetable, fresh, frozen, dried & Preserved	2.1063
Vegetables & Preparations, canned	2.1022
Fruits, Berries, dried, crystalized	2.1111
Fruits & Preparations, canned	2.1258
Eggs in the shell	1.7770

Table C (Continued)

Nuts, edible, not shelled	1.7797
Seeds except Oil & Seed grades	1.7755
Oil seeds, Nuts & Kernels	1.7758
Nuts, Kernels & Seed prepared	1.9136
Meal & Flour of other cereals & Vegetables	2.1055
Breakfast cereal products	2.2870
Biscuits	2.0535
Bread & Rolls	2.0679
Other baking products	2.0569
Cocoa & Chocolate	1.9003
Chocolate confectionery	1.8956
Other confectionery	1.9387
Sugar	1.3716
Molasses, Sugar, Refinery products	1.6754
Oilseed, Meal & Cake	1.9839
Maple sugar & Syrup	1.9141
Prepared cake & similar mixes	2.0656
Beet pulp	1.3716
Soups, dried & Soup mixes & bases	1.9949
Coffee, roasted, ground, prepared	1.9551
Tea	1.9756
Potato chips & similar products	1.9756
Miscellaneous food NES	2.0432
Soft-drink concentrates & syrup	2.1390
Carbonated beverage, Soft-drinks	2.1496
Soups, canned	2.1054
Pickles, Relishes, other sauces	2.1061
Vinegar	2.1062
Other food preparations	2.1801
Fish products	1.9548
Mustard, Mayonnaise	2.3460
Honeys & Beeswax	1.8628
Malt, Malt flour & Wheat starch	1.9776
Alcoholic beverages, distilled	1.7846
Alcohol, natural ethyl	1.7837
Brewers' & Distillers' grains	1.7913
Ale, Beer, Stout & Porter	1.7193
Wines	1.7455
Tobacco processed, unmanufactured	2.6169
Cigarettes	2.3286

Table C (Continued)

Tobacco, manufactured except cigarettes	2.3229
Tobacco raw	1.7755
Vegetable oils & fats, crude	1.9839
Feeds of animal origin NES	2.7017
Primary or concentrated feeds	2.3802
Feeds for commercial livestock	2.3826
Feed, grain origin NES	2.2912
Feed of vegetable origin NES	2.3806
Pet feeds	2.3914
Infant & junior foods, canned	2.0624
Hops including lupulin	1.7755
Hay forage & straw	1.9040
Hides & skins, raw NES	2.4673
Mink skins, ranch & undressed	1.7755
Wool in grease	1.7755
Services incidental to Agriculture & Forestry	1.7715
Forestry products	1.8404
Fishing & trapping products	1.4313
Textile products	1.8722
Knitted products & clothing	1.8743
Lumber, sawmill, other wood products	1.8742
Furniture & fixtures	1.8727
Paper & paper products	1.8743
Printing & Publishing	1.8740
Metallic ores & concentrates	1.6325
Minerals, Fuels	1.6143
Non-metallic minerals	1.6242
Services incidental to Mining	1.6140
Primary metal products	1.8745
Metal fabricated products	1.8738
Non-metallic minerals & products	1.8732
Petroleum & Coal products	1.8682
Chemicals, chemical products	1.8718
Nitrogen function compounds NES	1.8809
Autos, Trucks, other transportation equipment	1.8733
Transportation & storage	1.6216
Electrical & Communications products	1.8540
Communication services	1.2614
Other utilities	1.2902
Miscellaneous manufactured products	1.8656

Table C (Continued)

Non-residential construction	1.8083
Repair, construction	1.8083
Rubber, Leather, Plastic products	1.8732
Wholesale margin	1.5848
Retail margin	1.4943
Other finance, Insurance & Real Estate	1.4073
Business services	1.5650
Personal & other miscellaneous services	1.5599
Transportation margin	2.4225
Operating supplies - Office, Lab & Food	2.2513
Travel, Advertisement & Promotion	2.5272
Imputed rent, owner occupied dwellings	1.3959
Machinery & Equipment	1.8731
Residential construction	1.8083
Nursery stock & related Material	1.7755
Animal material for Drugs & perfume	2.6938
Custom work, meat & food	2.3155

Table D

1980 Output in 1961 Dollars ($'000)

Industry	Based Upon 1966, 1971 Final Demand	Based Upon 1961, 1966, 1971 Final Demand
Agriculture	6,510,106	6,983,790
Forestry	2,060,153	2,680,738
Slaughtering and Meat Processors	2,093,332	2,746,484
Poulty Processors	348,136	343,905
Dairy Factories	1,697,226	1,698,947
Fish Products Industry	539,051	556,364
Fruit and Vegetable Processors	665,481	814,183
Feed Manufacturers	835,042	907,711
Flour and Breakfast Cereal Industry	223,082	266,713
Biscuit Manufacturers	141,258	157,154
Bakeries	500,228	549,206
Confectionery Manufacturers	550,010	495,533
Sugar Refineries	897,244	575,006
Vegetable Oil Mills	180,646	215,446
Misc. Food Industry	1,180,328	1,144,991
Soft Drinks Manufacturers	449,034	473,397
Distillers	504,263	539,033
Breweries	611,895	594,327
Wineries	134,350	134,170
Leaf Tobacco Processing	198,650	247,583
Tobacco Product Manufacturers	394,015	578,682
Fish'g, Hunt'g and Trapp'g	248,933	284,141
Mines, Quarries, and Oil Wells	8,641,966	9,616,304
Manufacturing Except Food	76,011,072	100,292,911
Communications	6,750,219	6,694,200
Transportation and Storage	10,909,673	11,820,914
Electrical Power, Gas, Other Utilities	3,942,140	4,091,661
Wholesale Trade	9,492,407	10,187,711
Retail Trade	11,223,159	10,824,016
Finance, Insurance, Real Estate	21,548,504	21,131,613
Community Business, Personal Service	21,771,308	19,771,749
Transportation Margins	5,403,114	5,663,282
Construction	19,675,073	20,495,953
Operating Office, Lab and Food	10,338,917	11,529,888
Travel and Advertising Promotion	4,452,659	5,047,823

Table E

Percentage Change in Output (Per Annum)

Industry	Percentage Change Between 1961 to 1971	Percentage Change Between 1971 to 1980[a]	Percentage Change Between 1971 to 1980[b]
Agriculture	4.73	6.15	7.41
Forestry	2.48	11.57	18.40
Slaughtering & Meat Processors	3.82	3.64	8.25
Poultry Processors	6.03	5.97	5.77
Dairy Factories	2.67	5.12	5.13
Fish Products Industry	7.20	7.44	8.04
Fruit & Vegetable Processors	4.47	4.12	7.52
Feed Manufacturers	8.01	5.91	7.39
Flour and Breakfact Cereal Industry	-0.41	-1.28	0.60
Biscuit Manufacturers	3.65	3.14	4.75
Bakeries	1.33	2.03	3.33
Confectionery Mfgrs.	4.23	19.0	16.02
Sugar Refineries	2.38	49.9	28.0
Vegetable Oil Mills	8.15	6.19	9.53
Misc. Food Ind.	6.23	7.2	6.65
Soft Drink Mfgrs.	6.75	5.87	6.78
Distillers	8.29	6.21	7.41
Breweries	5.42	5.97	5.47
Wineries	19.47	16.2	16.16
Leaf Tobacco Processing	3.55	4.59	8.46
Tobacco Prod. Mfgrs.	3.34	3.07	9.72
Fish'g, Hunt'g & Trapp'g	4.32	4.51	6.73
Mines, Quarries & Oil Wells	8.28	12.34	15.0
Manufacturing Except Food	8.63	12.50	20.05
Communications	17.27	13.91	13.69

(Continued)

Table E (Continued)

Industry	Percentage Change Between 1961 to 1971	Percentage Change Between 1971 to 1980[a]	Percentage Change Between 1971 to 1980[b]
Transp. & Storage	7.24	8.94	10.62
Elec. Power, Gas, Other Utilities	9.86	10.24	11.05
Wholesale Trade	8.89	10.96	12.57
Retail Trade	5.39	7.65	6.98
Fin, Ins, Real Estate	7.73	8.79	8.41
Community Bus, Personal Service	10.87	16.11	13.61
Transp. Margins	6.78	10.07	12.27
Construction	7.18	6.84	7.59
Oper. Office, Lab & Food	10.31	10.64	13.15
Travel & Adver'g Promotion	6.55	10.09	12.92

[a]The output for 1980 is based upon 1966 and 1971 final demand.

[b]The output for 1980 is based upon 1961, 1966 and 1971 final demand.

Table F

1966 Output: Actual and with 1966 Impact Matrix

	Industry	1966 Output* (actual) (1)	1966 Output* with 1961 Impact Matrix (2)	Percentage Change $[\frac{2-1}{1} \times 100]$ (3)
		.........($'000)...........		
1.	Agriculture	4,064,800	4,147,146	+2.02
2.	Forestry	979,927	1,180,422	+20.46
3.	Slaughtering & Meat Processors	1,444,221	1,559,984	+8.01
4.	Poultry Processors	174,289	170,003	-2.46
5.	Dairy Factories	1,059,209	1,020,935	-3.61
6.	Fish Products Industry	279,280	275,917	-1.20
7.	Fruit & Veg. Processors	443,595	451,736	+1.83
8.	Feed Manufacturers	439,751	447,837	+1.83
9.	Flour & Breakfast Cereal Ind.	285,214	318,373	+11.62
10.	Bisc. Manufacturers	96,572	110,772	+14.70
11.	Bakeries	421,133	433,652	+2.97
12.	Confectionery Manufacturers	181,674	187,082	+2.97
13.	Sugar Refineries	154,479	156,099	+1.05
14.	Vegetable Oil Mills	94,143	92,749	-1.48
15.	Misc. Food Ind.	560,938	537,238	-4.22
16.	Soft Drinks Manufacturers	229,589	230,680	+0.47
17.	Distillers	247,947	245,110	-1.14
18.	Breweries	314,319	314,199	-0.04
19.	Wineries	28,566	28,351	-0.75
20.	Leaf Tobacco Processing	111,852	118,542	+6.0
21.	Tobacco Prod. Manufacturers	272,326	272,218	-0.04
22.	Fish'g, Hunt'g & Trapp'g	165,033	179,515	+0.77
23.	Mines, Quarries, & Oil Wells	3,064,662	3,191,527	+4.14
24.	Manufacturing Except Food	29,530,372	29,043,227	-1.65
25.	Communications	1,744,740	1,625,212	-6.85
26.	Transp. & Storage	4,705,830	4,833,739	+2.72
27.	Elec. Power, Gas, Other Utilities	1,420,541	1,421,121	+0.04
28.	Wholesale Trade	3,698,995	3,686,558	-0.33
29.	Retail Trade	5,409,372	5,436,086	+0.50
30.	Fin., Ins., Real Estate	8,908,192	8,982,380	+0.83

(Continued)

Table F (Continued)

Industry	1966 Output* (actual) (1)	1966 Output* with 1961 Impact Matrix (2)	Percentage Change [(2-1)/1 x 100] (3)
	.........($'000)...........		
31. Community Bus., Personal Serv.	5,920,723	5,807,131	-1.92
32. Transp. Margins	2,022,179	2,276,787	+12.60
33. Construction	9,509,553	9,774,762	+2.78
34. Oper. Office, Lab, & Food	4,043,970	3,761,067	-7.0
35. Travel & Adver'g Promotion	2,134,153	2,004,790	-6.06

*In 1961 dollars.

Table G

1971 Output: Actual and with 1966 Impact Matrix

Industry	1971 Output* (actual) (1)	1971 Output* with 1966 Impact Matrix (2)	Percentage Change [(2-1)/1 x 100] (3)
	.........($'000).........		
1. Agriculture	4,138,584	3,970,603	-4.05
2. Forestry	1,008,115	1,192,980	+18.33
3. Slaughtering & Meat Processors	1,561,792	1,494,657	-4.3
4. Poultry Processors	226,214	197,882	-12.52
5. Dairy Factories	1,160,495	1,145,003	-1.33
6. Fish Products Industry	322,195	326,142	+1.20
7. Fruit & Veg. Processors	484,837	488,200	+0.69
8. Feed Manufacturers	489,911	424,322	-13.38
9. Flour & Breakfast Cereal Ind.	181,304	198,983	+9.75
10. Bisc. Manufacturers	110,104	105,473	-4.20
11. Bakeries	422,670	424,985	+0.55
12. Confectionery Manufacturers	202,845	208,131	+2.60
13. Sugar Refineries	162,231	173,136	+6.72
14. Vegetable Oil Mills	112,086	94,882	-15.34
15. Misc. Food Ind.	683,304	682,850	-0.06
16. Soft Drinks Manufacturers	293,764	287,338	-2.18
17. Distillers	323,056	319,069	-1.23
18. Breweries	397,938	397,991	+0.01
19. Wineries	54,640	54,087	-1.01
20. Leaf Tobacco Processing	140,492	132,771	-5.49
21. Tobacco Prod. Manufacturers	308,624	310,649	+0.65
22. Fish'g, Hunt'g & Trapp'g	166,289	173,240	+4.18
23. Mines, Quarries & Oil Wells	4,090,234	4,136,322	+1,12
24. Manufacturing Except Food	35,724,052	38,066,853	+6.55
25. Communications	2,994,163	2,683,747	-10.36
26. Transp. & Storage	6,025,575	6,172,293	+2.43
27. Elec. Power, Gas, Other Utilities	2,048,817	1,979,209	-3.39
28. Wholesale Trade	4,769,005	4,943,574	+3.66
29. Retail Trade	6,643,448	6,879,992	+3.56
30. Fin., Ins., Real Estate	12,024,940	12,045,309	+0.17

(Continued)

Table G (Continued)

Industry	1971 Output* (actual) (1)	1971 Output* with 1966 Impact Matrix (2)	Percentage Change [(2-1)/1 x 100] (3)
	..........($'000).........		
31. Community Bus., Personal Serv.	8,878,601	8,286,444	-6.67
32. Transp. Margins	2,821,779	2,736,079	-3.03
33. Construction	12,173,677	12,219,529	+0.37
34. Oper. Office, Lab & Food	5,268,179	5,366,986	+1.87
35. Travel & Adver'g Promotion	2,323,794	2,754,690	+18.54

*In 1961 dollars.

Table 1

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY AGRICULTURE	FORESTRY	SLAUGHTERING & MEAT PROC ESSORS	POULTRY PROC ESSORS	DAIRY FACTOR IES	FISH PRODUCT S INDUSTRY	FRUIT & VEG. PROCESSORS	
CATTLE AND CALVES	1.8194	0.0	3.0200	0.0	0.0	0.0	0.0	1
SHEEP AND LAMBS	0.0	0.0	-55.C.64	0.0	0.0	0.0	0.0	2
HOGS	0.0	0.0	-7.6537	0.0	0.0	0.0	0.0	3
POULTRY	-38.9297	0.0	44.5489	40.3284	0.0	0.0	0.0	4
POULTRY,FRESH,FROZEN,CHILLED	0.0	0.0	0.0	-63.5435	0.0	0.0	-25.1715	5
POULTRY CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
OTHER LIVE ANIMALS	0.0	0.0	-33.6924	0.0	0.0	0.0	0.0	7
BEEF,VEAL,MUTTON,PORK-FRESH & FROZEN	0.0	0.0	-0.8924	144.2657	0.0	0.0	6.2738	8
HORSE MEAT FRESH,CHILLED,FROZEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
MEAT CURED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
MEAT,PREPARED,COOKED NOT CANNED	0.0	0.0	-11.4760	0.0	0.0	0.0	-35.4615	11
MEAT PREPARED CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12
ANIMAL OILS AND FATS AND LARD	0.0	0.0	5.4604	0.0	0.0	0.0	145.1099	13
MARGARINE,SHORTENING & LIKE PROD	0.0	0.0	0.0	0.0	0.0	0.0	171.7973	14
SAUSAGE CASINGS,NATURAL AND SYNTH.	0.0	0.0	43.1752	0.0	0.0	0.0	0.0	15
PRIMARY TANKAGE	0.0	0.0	177.5670	0.0	51.6959	0.0	0.0	16
MILK,WHOLE,FLUID,PROCESSED	0.0	0.0	-14.4718	0.0	-6.5583	0.0	-34.1555	17
MILK,WHOLE,FLUID,UNPROCESSED	0.0	0.0	0.0	0.0	-15.5410	0.0	0.0	18
FRESH CREAM	0.0	0.0	0.0	70.3697	-10.3209	0.0	152.4881	19
BUTTER	0.0	0.0	0.0	0.0	237.4993	0.0	175.3263	20
CHEESE,CHEDAR & PROCESSED	0.0	0.0	80.9630	-16.3840	35.7666	0.0	55.4596	21
MILK EVAPORATED	0.0	0.0	0.0	0.0	-13.0484	0.0	0.0	22
ICE CREAM	0.0	0.0	0.0	0.0	48.4491	0.0	0.0	23
OTHER DAIRY PROD	0.0	0.0	-7.7238	87.2614	28.9866	0.0	51.8124	24
RICE UNMILLED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25
WHEAT UNMILLED	-38.3979	0.0	0.0	0.0	0.0	0.0	0.0	26
BARLEY,OATS,RYE,CORN,GRAIN NES.	-25.0185	0.0	0.0	0.0	0.0	0.0	14.3025	27
WHEAT FLOUR	0.0	0.0	30.9743	82.0567	0.0	0.0	171.9020	28
FRUITS,FRESH,EX.TROPICAL	0.0	0.0	-10.7342	82.0567	37.7079	89.9167	-19.2005	29
VEGETABLES,FRESH	0.0	0.0	-15.0843	38.4254	0.0	79.6116	-2.9929	30
VEG.FRESH,FROZEN,DRIED & PRESERVED	0.0	0.0	-8.4800	45.6454	0.0	0.0	6.7693	31
VEGETABLES & PREPARATIONS CANNED	0.0	0.0	-10.3683	0.0	0.0	90.4651	-2.3817	32
FRUITS,BERRIES,DRIED,CRYSTALIZED	0.0	0.0	0.0	0.0	32.7184	0.0	31.5855	33
FRUITS & PREPARATIONS CANNED	0.0	0.0	0.0	0.0	-22.2032	0.0	-52.6231	34
EGGS IN THE SHELL	0.0	0.0	0.0	0.0	-100.0000	0.0	153.8779	35
NUTS,EDIBLE,NOT SHELLED	0.0	0.0	0.0	0.0	26.8425	0.0	154.9081	36
SEEDS EX.OIL AND SEED GRADES	-23.8725	0.0	0.0	0.0	0.0	0.0	0.0	37
OIL SEEDS,NUTS AND KERNELS	-30.1328	0.0	0.0	0.0	0.0	0.0	160.6431	38
NUTS,KERNELS AND SEEDS PREPARED	0.0	0.0	0.0	0.0	25.9627	0.0	46.4087	39
MEAL & FLOUR OF OTHER CEREALS & VEG.	0.0	0.0	-7.6910	0.0	163.5277	0.0	20.6697	40
BREAKFAST CEREAL PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41
BISCUITS	0.0	0.0	-17.3073	0.0	35.8999	0.0	164.6285	42
BREAD & ROLLS	0.0	0.0	0.0	0.0	0.0	89.6205	0.0	43
OTHER BAKING PRODUCTS	0.0	0.0	0.0	0.0	34.3762	0.0	162.1912	44
COCOA AND CHOCOLATE	0.0	0.0	0.0	0.0	41.7308	0.0	162.2893	45
CHOCOLATE CONFECTIONERY	0.0	0.0	0.0	0.0	36.9755	0.0	0.0	46
OTHER CONFECTIONERY	0.0	0.0	0.0	0.0	29.6613	0.0	171.9020	47
SUGAR	0.0	0.0	-33.2816	0.0	33.3397	0.0	-10.1076	48
MOLASSES,SUGAR REFINERY PRODUCTS	0.0	0.0	-10.2731	0.0	36.2682	0.0	165.9392	49
OILSEED,MEAL & CAKE	51.2232	0.0	0.0	0.0	0.0	0.0	0.0	50
MAPLE SUGAR & SYRUP	0.0	0.0	0.0	0.0	122.1823	0.0	-100.0000	51
PREPARED CAKE & SIMILAR MIXES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52
BEET PULP	-42.5588	0.0	0.0	0.0	0.0	0.0	0.0	53

Table 2

Percentage Change in Input: 1961-66

COMMODITY	AGRICULTURE	FORESTRY	SLAUGHTERING & MEAT PROCESSORS	POULTRY PROCESSORS	DAIRY FACTORIES	FISH PRODUCTS INDUSTRY	FRUIT & VEG. PROCESSORS	
	INDUSTRY							
SOUPS,DRIED & SOUP MIXES & BASES	0.0	0.0	-2.9979	0.0	0.0	0.0	0.0	54
COFFEE,ROASTED,GROUND,PREPARED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55
TEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56
POTATO CHIPS & SIMILAR PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57
MISC. FOOD NES	0.0	0.0	9.7307	43.3283	25.6183	448.8631	-100.0000	58
SOFTDRINK CONCENTRATES & SYRUP	0.0	0.0	0.0	0.0	23.6387	0.0	-100.0000	59
CARBONATED BEV. SOFT DRINKS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60
SOUPS CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61
PICKLES,RELISHES,OTHER SAUCES	0.0	0.0	-12.0227	77.2318	59.6157	0.0	175.7546	62
VINEGAR	0.0	0.0	0.0	0.0	-4.9327	-35.2153	-23.7105	63
OTHER FOOD PREPARATIONS	0.0	0.0	0.0	0.0	30.8400	0.0	0.0	64
FISH PRODUCTS	0.0	0.0	-69.1577	0.0	0.0	-26.5401	178.4802	65
MUSTARD MAYONNAISE	0.0	0.0	0.0	0.0	0.0	87.0618	0.0	66
HONEY AND BEESWAX	0.0	0.0	0.0	0.0	151.3966	0.0	0.0	67
MALT,MALT FLOUR & WHEAT STARCH	0.0	0.0	-9.8759	0.0	0.0	0.0	165.8447	68
ALCOHOLIC BEVERAGES DISTILLED	0.0	0.0	0.0	0.0	0.0	0.0	-100.0000	69
ALCOHOL,NATURAL ETHYL	0.0	0.0	0.0	0.0	0.0	0.0	-100.0000	70
BREWERS& DISTILLERS' GRAINS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71
ALE,BEER,STOUT & PORTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72
WINES	0.0	0.0	0.0	0.0	0.0	0.0	-100.0000	73
TOBACCO PROCESSED,UNMANUFACTURED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74
CIGARETTES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75
TOBACCO MFG EX.CIGARETTES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76
TOBACCO RAW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77
VEG,OILS & FATS,CRUDE	0.0	0.0	-26.7208	0.0	0.0	0.0	0.0	78
FEEDS OF ANIMAL ORIGIN NES	141.3291	0.0	-9.8868	0.0	0.0	0.0	0.0	79
PRIMARY OR CONCENTRATED FEEDS	1.9813	0.0	-10.8285	0.0	0.0	0.0	0.0	80
FEEDS FOR COMMERCIAL LIVESTOCK	-5.1011	-55.2124	-11.4104	0.0	0.0	0.0	0.0	81
FEEDS,GRAIN ORIGIN NES	10.0343	0.0	0.0	0.0	0.0	0.0	162.4263	82
FEEDS OF VEG.ORIGIN NES	-18.5700	0.0	0.0	0.0	0.0	0.0	0.0	83
PET FEEDS	-3.5281	0.0	0.0	0.0	0.0	0.0	0.0	84
INFANT & JUNIOR FOODS CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85
HOPS INCLUDING LUPULIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86
HAY FORAGE & STRAW	-48.8498	-71.5661	-8.9218	0.0	0.0	0.0	0.0	87
HIDES & SKINS,RAW NES	0.0	0.0	-28.9079	0.0	0.0	0.0	0.0	88
MINK SKINS,RANCH & UNDRESSED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89
WOOL IN GREASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
SERV.INCIDENTAL TO AG.& FORESTRY	-12.1343	0.0	0.0	0.0	0.0	0.0	0.0	91
FORESTRY PROD	-37.3116	-15.2614	-13.7773	82.0567	34.6804	87.3681	171.9020	92
FISHING & TRAPPING PROD.	0.0	0.0	0.0	0.0	0.0	-0.5173	0.0	93
TEXTILE PRODUCTS	-23.9218	1.9920	-11.5255	80.4707	71.2309	85.7564	176.9263	94
KNITTED PRODUCTS & CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95
LUMBER,SAWMILL,OTHER WOOD PRODUCTS	-43.8641	-13.5552	-17.1131	27.0584	8.5577	10.7682	163.0174	96
FURNITURE & FIXTURES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97
PAPER & PAPER PRODUCTS	-13.9870	0.0	-10.0229	-23.8338	33.7440	94.1645	-4.9960	98
PRINTING & PUBLISHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99
METALLIC ORES & CONCENTRATES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
MINERALS FUELS	106.3237	23.5879	-46.0924	5.1673	-34.4234	-72.0187	-63.0670	101
NON-METALLIC MINERALS	-29.4351	0.0	-36.1004	-62.9218	2.0561	-36.7286	-6.7546	102
SERVICES INCIDENTAL TO MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103
PRIMARY METAL PRODUCTS	0.0	0.0	0.0	0.0	25.0506	-23.0459	0.0	104
METAL FABRICATED PRODUCTS	-4.4274	-2.3136	-16.9477	-16.7874	-28.5002	-27.6455	-25.6220	105
NON-METALLIC MINERALS PRODUCTS	-11.9245	-0.6115	-9.6158	80.0942	20.4006	91.9215	-18.7012	106

Table 3

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY: AGRICULTURE	FORESTRY	SLAUGHTERING & MEAT PROCESSORS	POULTRY PROCESSORS	DAIRY FACTORIES	FISH PRODUCTS INDUSTRY	FRUIT & VEG. PROCESSORS	
PET & COAL PRODUCTS.	-18.7997	7.6295	24.1159	29.4706	14.6032	7.5256	80.2591	107
CHEMICALS,CHEMICAL PRODUCTS	27.8520	16.7890	-15.1820	361.3988	92.7295	84.7862	103.6032	108
NITROGEN FUNCTION COMPOUNDS NES	0.0	0.0	0.0791	0.0	52.1395	0.0	0.0	109
AUTOS,TRUCKS,OTHER TRANSP. EQUIPMENT	-31.1847	7.9287	0.0	0.0	0.0	0.0	0.0	110
TRANSPORTATION & STORAGE	-23.8886	-4.0180	4.7511	11.1791	-11.9998	-10.6530	-4.9720	111
ELEC & COMMUNICATIONS PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
COMUNICATION SERVICES	-21.1771	11.0761	16.6630	37.8687	17.4956	7.2655	7.3315	113
OTHER UTILITIES	9.0138	-1.0414	1.4511	36.6492	7.7616	24.8594	61.5361	114
MISC. MANUF.PRODUCTS	0.0	0.0	523.0207	80.3408	28.7351	94.0279	0.0	115
NON-RESIDENTIAL CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116
REPAIR CONSTRUCTION	21.4162	-30.8811	-18.4830	-34.9715	-28.5748	-23.4385	-12.3967	117
RUBBER,LEATHER.PLASTIC PRODUCTS	-13.9401	0.0	332.7080	248.6058	229.8855	0.0	928.0852	118
WHOLESALE MARGIN	-16.9149	-7.4672	5.5914	40.5910	21.3337	328.6579	11.6439	119
RETAIL MARGIN	-7.1623	-6.1788	28.5190	44.6051	23.1778	32.9399	32.0516	120
OTHER FINANCE,INS & REAL ESTATE	19.4925	12.8501	0.2917	-43.8242	-19.3081	-8.7689	-1.9713	121
BUSINESS SERVICES	-6.8546	-0.5623	17.3337	42.8167	44.2051	11.3631	8.7729	122
PERSONAL & OTHER MISC.SERVICES	-18.2225	28.8006	4.2853	23.2058	3.2677	-3.8733	-3.8269	123
TRANSPORTATION MARGIN	-21.3920	-17.3767	-13.2201	14.4055	50.0591	47.0234	-15.6431	124
OPERATING OFFICE & LAB & FOOD	5.5624	7.6671	15.6717	20.2008	27.3350	-2.3204	86.9857	125
TRAVEL ,ADVERTISEMENT & PROMOTION	74.7318	2.3586	11.2021	38.0822	20.6313	7.8735	8.5550	126
IMPUTED RENT.OWNER OCCUPIED DWELL'GS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127
MACHINERY & EQUIPMENT	-32.5776	-2.7179	0.0	0.0	0.0	0.0	0.0	128
RESIDENTIAL CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129
NURSERY STOCK & RELATED MAT.	-17.0768	0.0	0.0	0.0	0.0	0.0	0.0	130
ANIMAL MAT.FOR DRUGS&PERFUME	0.0	0.0	-100.0000	0.0	0.0	0.0	0.0	131
CUSTOM WORK MEAT&FOOD	0.0	0.0	38.1678	-78.2074	-20.2833	-46.5117	0.4393	132
NON-COMPETING IMPORTS	0.0	0.0	-12.0930	0.0	0.0	0.0	88.0380	133
UNALLOCATED IMPORTS & EXPORTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	134
INDIRECT TAXES	-113.6824	26.7894	10.2073	18.0941	-61.4874	-4.8928	7.5916	135
LABOR INCOME	-37.7497	-6.9474	-20.5908	8.1441	-13.0098	-7.4711	-11.0205	136
NET INCOME UNINCORPORATED BUSINESS	38.6534	-51.2503	-16.1696	-61.9165	-51.9835	-39.7150	-43.9028	137
OTHER OPERATING SURPLUS	4.4344	-9.3409	39.4809	47.1535	14.2550	-47.3435	-11.0361	138

Table 4

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY: FEED MANUFAC TURERS	FLOUR & BREA KFAST CEREAL IND.	BISC. MFGRS.	BAKERIES	CONFECTIONER Y MFGRS.	SUGAR REFINE RIES	VEGETABLE OI L MILLS	
CATTLE AND CALVES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
SHEEP AND LAMBS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
HOGS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
POULTRY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
POULTRY,FRESH,FROZEN,CHILLED	0.0	0.0	0.0	14.2275	0.0	0.0	0.0	5
POULTRY CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
OTHER LIVE ANIMALS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
BEEF,VEAL,MUTTON,PORK-FRESH & FROZEN	-32.7706	0.0	0.0	-49.8589	0.0	0.0	0.0	8
HORSE MEAT FRESH,CHILLED,FROZEN	-26.3950	0.0	0.0	0.0	0.0	0.0	0.0	9
MEAT CURED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
MEAT,PREPARED,COOKED NOT CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11
MEAT PREPARED CANNED	0.0	0.0	0.0	20.8623	0.0	0.0	0.0	12
ANIMAL OILS AND FATS AND LARD	-35.9633	113.7667	1.0243	-27.0802	-62.7885	0.0	0.0	13
MARGARINE,SHORTENING & LIKE PROD	-100.0000	63.9775	5.2922	-6.7811	-0.3531	0.0	0.0	14
SAUSAGE CASINGS,NATURAL AND SYNTH.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15
PRIMARY TANKAGE	-23.0829	0.0	0.0	0.0	0.0	0.0	0.0	16
MILK,WHOLE,FLUID,PROCESSED	0.0	0.0	0.0	-28.7238	0.0	0.0	0.0	17
MILK,WHOLE,FLUID,UNPROCESSED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18
FRESH CREAM	0.0	0.0	0.0	-48.6241	65.9824	0.0	0.0	19
BUTTER	0.0	0.0	-8.4063	22.0933	126.2136	0.0	0.0	20
CHEESE,CHEDAR & PROCESSED	0.0	0.0	23.7964	27.4174	0.0	0.0	0.0	21
MILK EVAPORATED	0.0	0.0	-78.9560	-61.8799	-59.5679	0.0	0.0	22
ICE CREAM	0.0	0.0	0.0	50.5644	0.0	0.0	0.0	23
OTHER DAIRY PROD	81.1583	137.5180	62.8115	28.0121	35.7354	0.0	0.0	24
RICE UNMILLED	193.8882	-12.3091	0.0	0.0	0.0	0.0	0.0	25
WHEAT UNMILLED	-7.3061	2.2071	0.0	0.0	0.0	0.0	0.0	26
BARLEY,OATS,RYE,CORN,GRAIN NES.	0.9809	-13.3055	56.9899	0.0	-34.1716	0.0	0.0	27
WHEAT FLOUR	-29.3043	-1.4212	-1.5279	3.5666	-52.4567	0.0	0.0	28
FRUITS,FRESH,EX.TROPICAL	0.0	0.0	4.5005	48.5025	-62.6401	0.0	0.0	29
VEGETABLES,FRESH	-72.0106	3.4216	-100.0000	32.9762	-61.6740	-35.2644	0.0	30
VEG.FRESH,FROZEN,DRIED & PRESERVED	-28.8718	0.0	0.0	41.3339	0.0	0.0	0.0	31
VEGETABLES & PREPARATIONS CANNED	0.0	0.0	0.0	38.0931	0.0	0.0	0.0	32
FRUITS,BERRIES,DRIED,CRYSTALIZED	0.0	-8.3656	5.2800	-0.6018	-35.9191	0.0	0.0	33
FRUITS & PREPARATIONS CANNED	0.0	0.0	26.3368	-0.8351	50.2978	0.0	0.0	34
EGGS IN THE SHELL	0.0	0.0	-47.6700	-56.9653	-16.1620	0.0	0.0	35
NUTS,EDIBLE,NOT SHELLED	0.0	0.0	-95.5756	31.5539	-68.0712	0.0	0.0	36
SEEDS EX.OIL AND SEED GRADES	19.5019	0.0	0.0	0.0	0.0	0.0	0.0	37
OIL SEEDS,NUTS AND KERNELS	143.3207	-0.5112	57.7223	35.6569	-13.4350	0.0	-6.3947	38
NUTS,KERNELS AND SEEDS PREPARED	0.0	0.0	-33.7472	-2.4155	0.1348	0.0	0.0	39
MEAL & FLOUR OF OTHER CEREALS & VEG.	295.4492	-24.5107	32.0283	-8.6047	51.8463	3.1803	0.0	40
BREAKFAST CEREAL PRODUCTS	0.0	-100.0000	0.0	0.0	-58.6915	0.0	0.0	41
BISCUITS	-25.9212	0.0	-2.8376	37.8765	-58.3361	0.0	0.0	42
BREAD & ROLLS	0.0	0.0	-100.0000	39.9464	0.0	0.0	0.0	43
OTHER BAKING PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44
COCOA AND CHOCOLATE	0.0	-9.0694	-38.3951	46.8474	-12.8084	0.0	0.0	45
CHOCOLATE CONFECTIONERY	0.0	0.0	0.0	0.0	-57.5856	0.0	0.0	46
OTHER CONFECTIONERY	0.0	0.0	65.1782	41.0357	-57.5070	0.0	0.0	47
SUGAR	-16.5300	12.9631	-9.8913	4.6450	38.7570	0.0	0.0	48
MOLASSES,SUGAR REFINERY PRODUCTS	-4.8007	-65.0917	-38.3663	26.4452	-58.4890	0.0	0.0	49
OILSEED,MEAL & CAKE	-5.8588	-27.9167	0.0	0.0	0.0	0.0	0.0	50
MAPLE SUGAR & SYRUP	0.0	-33.9332	6.2620	143.1871	7.4359	0.0	0.0	51
PREPARED CAKE & SIMILAR MIXES	0.0	0.0	0.0	18.0996	0.0	0.0	0.0	52
BEET PULP	35.0478	-17.0927	0.0	0.0	0.0	0.0	0.0	53

Table 5

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY FEED MANUFAC TURERS	FLOUR & BREA KFAST CEREAL IND.	BISC. MFGRS.	BAKERIES	CONFECTIONER Y MFGRS.	SUGAR REFINE RIES	VEGETABLE OI L MILLS	
SOUPS,DRIED & SOUP MIXES & BASES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54
COFFEE,ROASTED,GROUND,PREPARED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55
TEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56
POTATO CHIPS & SIMILAR PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57
MISC. FOOD NES	54.4869	0.0202	-28.5061	9.9665	2.0635	0.0	-15.8639	58
SOFTDRINK CONCENTRATES & SYRUP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59
CARBONATED BEV. SOFT DRINKS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60
SOUPS CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61
PICKLES,RELISHES,OTHER SAUCES	0.0	0.0	0.0	43.5023	0.0	0.0	0.0	62
VINEGAR	0.0	0.0	0.0	25.3090	0.0	0.0	0.0	63
OTHER FOOD PREPARATIONS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64
FISH PRODUCTS	-25.7555	51.9967	0.0	44.3861	0.0	0.0	0.0	65
MUSTARD MAYONNAISE	0.0	0.0	0.0	40.9354	0.0	0.0	0.0	66
HONEY AND BEESWAX	0.0	7.4510	25.2182	-59.3790	-59.7577	0.0	0.0	67
MALT,MALT FLOUR & WHEAT STARCH	-88.6766	-29.0370	16.3756	11.1925	-59.6750	-71.2098	0.0	68
ALCOHOLIC BEVERAGES DISTILLED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69
ALCOHOL,NATURAL ETHYL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70
BREWERS& DISTILLERS' GRAINS	27.0717	-13.6141	0.0	0.0	0.0	0.0	0.0	71
ALE,BEER,STOUT & PORTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72
WINES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73
TOBACCO PROCESSED,UNMANUFACTURED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74
CIGARETTES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75
TOBACCO MFG EX.CIGARETTES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76
TOBACCO RAW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77
VEG,OILS & FATS,CRUDE	0.0	0.0	0.0	0.0	-58.6410	0.0	2238.2820	78
FEEDS OF ANIMAL ORIGIN NES	21.6600	10.2748	0.0	0.0	0.0	0.0	0.0	79
PRIMARY OR CONCENTRATED FEEDS	11.7895	-7.1997	0.0	0.0	0.0	0.0	0.0	80
FEEDS FOR COMMERCIAL LIVESTOCK	34.1472	-71.3013	0.0	0.0	0.0	0.0	0.0	81
FEEDS,GRAIN ORIGIN NES	-13.9422	-6.2683	0.0	0.0	0.0	0.0	0.0	82
FEEDS OF VEG.ORIGIN NES	-39.8982	-89.4984	0.0	0.0	0.0	0.0	0.0	83
PET FEEDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84
INFANT & JUNIOR FOODS CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85
HOPS INCLUDING LUPULIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86
HAY FORAGE & STRAW	-41.4368	0.0	0.0	0.0	0.0	0.0	0.0	87
HIDES & SKINS,RAW NES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88
MINK SKINS,RANCH & UNDRESSED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89
WOOL IN GREASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
SERV.INCIDENTAL TO AG.& FORESTRY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91
FORESTRY PROD	-38.1566	0.0	0.0	37.5336	0.0	0.0	0.0	92
FISHING & TRAPPING PROD.	8.3089	0.0	0.0	0.0	0.0	0.0	0.0	93
TEXTILE PRODUCTS	-32.0516	-20.6658	61.1124	25.3063	-57.1286	-52.4988	-16.1559	94
KNITTED PRODUCTS & CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95
LUMBER,SAWMILL,OTHER WOOD PRODUCTS	-45.4640	-0.9464	-12.6035	215.9731	-66.0562	0.0	0.0	96
FURNITURE & FIXTURES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97
PAPER & PAPER PRODUCTS	-28.3871	-12.9911	-11.1804	-5.0062	-6.6349	-25.1931	-11.5408	98
PRINTING & PUBLISHING	0.0	0.0	58.9780	0.0	-59.7128	0.0	0.0	99
METALLIC ORES & CONCENTRATES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
MINERALS FUELS	29.1356	-19.2639	13.1601	-10.5029	-61.1173	-36.0846	-60.9304	101
NON-METALLIC MINERALS	-14.6836	23.8244	4.4022	-30.6069	-60.0771	-18.4313	C.0	102
SERVICES INCIDENTAL TO MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103
PRIMARY METAL PRODUCTS	-40.9941	0.0	0.0	0.0	-54.6271	0.0	-21.5606	104
METAL FABRICATED PRODUCTS	-35.6270	-13.3267	50.0178	27.9888	-61.2372	-78.4528	-19.7778	105
NON-METALLIC MINERALS PRODUCTS	-37.0240	0.0	68.2035	62.1661	-57.4156	-30.3177	0.0	106

Table 6

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY: FEED MANUFACTURERS	FLOUR & BREAKFAST CEREAL IND.	BISC. MFGRS.	BAKERIES	CONFECTIONERY MFGRS.	SUGAR REFINERIES	VEGETABLE OIL MILLS	
PET & COAL PRODUCTS.	35.1115	4.6218	26.7090	15.3278	1.5578	29.8134	-23.4654	107
CHEMICALS,CHEMICAL PRODUCTS	5.5798	15.0833	10.5552	2.4421	12.6355	49.6285	78.2182	108
NITROGEN FUNCTION COMPOUNDS NES	-22.4002	0.0	117.7757	50.3653	-52.4308	0.0	-4.2867	109
AUTOS,TRUCKS,OTHER TRANSP. EQUIPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110
TRANSPORTATION & STORAGE	-5.2850	-12.7230	-21.6276	-7.8195	7.1294	-42.4205	88.9449	111
ELEC & COMMUNICATIONS PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112
COMUNICATION SERVICES	19.3278	13.5630	14.3191	13.2788	13.0751	-4.2250	10.9702	113
OTHER UTILITIES	-12.0252	-7.2572	0.0364	18.8048	-7.5316	-19.8842	31.9048	114
MISC. MANUF.PRODUCTS	0.0	10.9211	-100.0000	0.0	-58.7243	0.0	0.0	115
NON-RESIDENTIAL CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116
REPAIR CONSTRUCTION	-30.3540	-53.4183	18.7575	-8.1148	-31.7454	-37.5283	-23.8136	117
RUBBER,LEATHER.PLASTIC PRODUCTS	0.0	7.6684	217.2335	174.5652	68.9319	-79.6082	0.0	118
WHOLESALE MARGIN	28.3040	20.0601	-3.0113	10.2539	2.1252	22.9520	123.4892	119
RETAIL MARGIN	-8.2119	5.0498	20.4988	47.6486	-42.2394	6.7158	-35.3995	120
OTHER FINANCE,INS & REAL ESTATE	-38.3241	26.7664	3.7152	8.0296	6.1324	81.9215	-19.9105	121
BUSINESS SERVICES	19.7394	15.4694	14.3292	17.9287	15.4494	-2.9538	14.0842	122
PERSONAL & OTHER MISC.SERVICES	6.6535	2.1472	2.1303	1.2519	1.2379	-14.4593	-1.6515	123
TRANSPORTATION MARGIN	-0.9829	-19.3143	-11.9514	-11.7941	-21.9969	-25.7061	4.0537	124
OPERATING OFFICE & LAB & FOOD	-17.2443	-1.0913	19.5754	24.9643	-8.7389	105.0676	15.0208	125
TRAVEL ,ADVERTISEMENT & PROMOTION	13.9526	11.8271	13.7345	13.7087	7.7573	-5.9361	11.4720	126
IMPUTED RENT.OWNER OCCUPIED DWELL'GS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127
MACHINERY & EQUIPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128
RESIDENTIAL CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129
NURSERY STOCK & RELATED MAT.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130
ANIMAL MAT.FOR DRUGS&PERFUME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	131
CUSTOM WORK MEAT&FOOD	-35.7946	2722.2324	-87.8520	-73.1412	264.3362	0.0	123.7642	132
NON-COMPETING IMPORTS	0.0	0.0	0.0	0.0	-26.5157	-23.1301	0.0	133
UNALLOCATED IMPORTS & EXPORTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	134
INDIRECT TAXES	-38.2604	26.9561	27.5467	22.9618	9.5311	19.4772	-5.4755	135
LABOR INCOME	-25.9934	-9.3930	-10.0801	-7.5384	-14.9544	-18.4262	-31.9543	136
NET INCOME UNINCORPORATED BUSINESS	-54.2913	-34.9445	-15.4181	-33.4030	-44.4942	0.0	0.0	137
OTHER OPERATING SURPLUS	16.6154	-10.0994	18.4157	-35.1364	35.8377	-12.9175	-6.9839	138

Table 7

Percentage Change in Input: 1961-66

COMMODITY	INDUSTRY MISC.FOOD IND.	SOFT DRINKS MFGRS.	DISTILLERS	BREWERIES	WINERIES	LEAF TOBACCO PROCESSING	TOBACCO PROD .MFGRS.	
CATTLE AND CALVES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
SHEEP AND LAMBS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
HOGS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
POULTRY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
POULTRY,FRESH,FROZEN,CHILLED	-16.6424	0.0	0.0	0.0	0.0	0.0	0.0	5
POULTRY CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
OTHER LIVE ANIMALS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
BEEF,VEAL,MUTTON,PORK-FRESH & FROZEN	-79.7423	0.0	0.0	0.0	0.0	0.0	0.0	8
HORSE MEAT FRESH,CHILLED,FROZEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
MEAT CURED	-84.3832	0.0	0.0	0.0	0.0	0.0	0.0	10
MEAT,PREPARED,COOKED NOT CANNED	739.6092	0.0	0.0	0.0	0.0	0.0	0.0	11
MEAT PREPARED CANNED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12
ANIMAL OILS AND FATS AND LARD	-11.7700	0.0	0.0	0.0	0.0	0.0	0.0	13
MARGARINE,SHORTENING & LIKE PROD	1.6750	0.0	0.0	0.0	0.0	0.0	0.0	14
SAUSAGE CASINGS,NATURAL AND SYNTH.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15
PRIMARY TANKAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16
MILK,WHOLE,FLUID,PROCESSED	-17.3567	0.0	0.0	0.0	0.0	0.0	0.0	17
MILK,WHOLE,FLUID,UNPROCESSED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18
FRESH CREAM	-62.3537	0.0	0.0	0.0	0.0	0.0	0.0	19
BUTTER	-5.5859	0.0	0.0	0.0	0.0	0.0	0.0	20
CHEESE,CHEDAR & PROCESSED	-6.3370	0.0	0.0	0.0	0.0	0.0	0.0	21
MILK EVAPORATED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22
ICE CREAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23
OTHER DAIRY PROD	4.6116	0.0	0.0	0.0	0.0	0.0	0.0	24
RICE UNMILLED	-3.8402	0.0	0.0	0.0	0.0	0.0	0.0	25
WHEAT UNMILLED	-81.9481	0.0	631.0130	0.0	0.0	0.0	0.0	26
BARLEY,OATS,RYE,CORN,GRAIN NES.	-1.9043	0.0	8.4365	-11.2076	0.0	0.0	0.0	27
WHEAT FLOUR	-1.1057	0.0	0.0	0.0	0.0	0.0	0.0	28
FRUITS,FRESH,EX.TROPICAL	-46.0848	0.0	0.0	0.0	15.8013	0.0	0.0	29
VEGETABLES,FRESH	0.0594	0.0	0.0	0.0	0.0	0.0	0.0	30
VEG.FRESH,FROZEN,DRIED & PRESERVED	14.3385	0.0	0.0	0.0	0.0	0.0	0.0	31
VEGETABLES & PREPARATIONS CANNED	106.0786	0.0	0.0	0.0	0.0	0.0	0.0	32
FRUITS,BERRIES,DRIED,CRYSTALIZED	-9.4675	132.3076	13.2640	0.0	-51.0490	0.0	0.0	33
FRUITS & PREPARATIONS CANNED	269.6854	0.0	0.0	0.0	0.0	0.0	0.0	34
EGGS IN THE SHELL	-17.0292	0.0	0.0	0.0	0.0	0.0	0.0	35
NUTS,EDIBLE,NOT SHELLED	-3.7569	0.0	0.0	0.0	0.0	0.0	0.0	36
SEEDS EX.OIL AND SEED GRADES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37
OIL SEEDS,NUTS AND KERNELS	-1.3450	0.0	0.0	0.0	0.0	0.0	0.0	38
NUTS,KERNELS AND SEEDS PREPARED	318.4756	0.0	0.0	0.0	0.0	0.0	0.0	39
MEAL & FLOUR OF OTHER CEREALS & VEG.	45.1605	0.0	0.0	-16.7319	0.0	0.0	0.0	40
BREAKFAST CEREAL PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41
BISCUITS	2.9854	0.0	0.0	0.0	0.0	0.0	0.0	42
BREAD & ROLLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43
OTHER BAKING PRODUCTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44
COCOA AND CHOCOLATE	0.5051	0.0	0.0	0.0	0.0	0.0	0.0	45
CHOCOLATE CONFECTIONERY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46
OTHER CONFECTIONERY	-82.4311	0.0	0.0	0.0	0.0	0.0	0.0	47
SUGAR	1.4569	-12.3250	25.0930	-24.6232	73.7735	0.0	-28.1983	48
MOLASSES,SUGAR REFINERY PRODUCTS	-38.5268	0.0	-8.4228	0.0	0.0	0.0	14.3081	49
OILSEED,MEAL & CAKE	-82.4311	0.0	0.0	0.0	0.0	0.0	0.0	50
MAPLE SUGAR & SYRUP	6.9298	0.0	0.0	11.8030	0.0	0.0	0.0	51
PREPARED CAKE & SIMILAR MIXES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52
BEET PULP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53