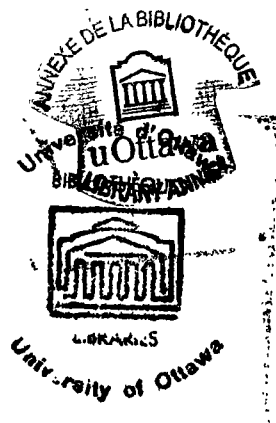


MANUFACTURING AND EXPORTS, CANADA, 1920-1965

by

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INTRODUCTION

Industrial development is generally a function of several variables. Indeed, growth originates from a combination of political, social and economic factors. Canada's industrial development has not differed significantly from this suggested pattern. There is, however, one factor, namely exports, that has considerably influenced this country's economic progress. The reason for this apparent close association between exports and development can be explained in part by the particular geographical position which Canada occupies, the amount, type and quality of natural resources with which she is endowed, as well as the growing world demand for products which Canada is able to produce on a competitive basis (quality, prices, delivery, credit terms, etc.).

It is the purpose of this thesis to examine further this particular variable, i.e. exports, and to evaluate qualitatively and quantitatively the impact that it has upon the Canadian economy on the aggregate and its major sector: manufacturing. Specifically, this thesis attempts to achieve four particular objectives.

First, it presents data, including where necessary,

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estimates of the main economic flows affecting Canadian economic development including exports, investment, output, etc. covering the years 1920-1965. Secondly, it endeavours to measure and assess the degree of correlation between exports (manufactured goods including partially and fully manufactured items, and goods and services) and output (manufacturing industries and total economy) in order to establish whether and to what extent there exists a behavioural relationship. Thirdly, the thesis attempts to calculate the impact and equilibrium export multipliers (for the manufacturing sector and the aggregate economy) in order to evaluate the difference in the effects which the two types of exports (manufactured goods and goods and services) have on output. Fourthly, this thesis attempts to formulate some generalizations in the light of the results obtained.

Two main considerations have influenced the selection of this topic. The first is the renewed academic discussion on the relative importance of the income determining factors, particularly as they apply to the Canadian economy, that is, whether real or monetary factors are responsible for stability and growth of income. This thesis will concentrate on the examination of some of the "real" aspects, placing special emphasis on the two variables: exports and investments. The second is the

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extensive talks and recent agreements on tariff cuts in Geneva which have accentuated the need for an analysis of the response of income to changes in exports. It is in fact in view of the expected increase in the level of trade with foreign countries that the areas of possible Canadian comparative advantages should be thoroughly examined.

The problem outlined above appears to be essentially of a quantitative nature. Numerical results are the main objectives of this study, but cause and effect relationships and "gestation periods" are also analyzed.⁽¹⁾ The method of approach, therefore, becomes theoretical, historical as well as statistical. In other words, this dissertation analyzes in a statistical fashion some of the relevant economic events which have taken place during the past forty-five years. Economic theory provides a basis for the choice of the variables as well as for the method of analysis.

Specifically, this thesis consists of an examination over time of changes in exports and output. The analysis has been subdivided into five Chapters and three Appendices. The first Chapter describes a few of the main factors contributing to the growth of the Canadian

(1) "Gestation period" may be here defined as the time elapsing between a change in the exogenous variable and the consequent, completed effect on the economic system (see pp. 62-64 in the text for further reference).

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manufacturing industries. The second Chapter deals with definitions and points out some of the difficulties encountered in developing a set of consistent data. Of the various alternatives open, one set of data is chosen and reasons for it and the limitations of the ensuing results are mentioned. The theoretical approach followed as well as the models adopted are shown in the third Chapter. The results are tabulated and analyzed in the fourth Chapter. The fifth Chapter, finally, puts forward some conclusions and points out areas of possible further research.

Graphical representations of several of the functional relationships examined in this thesis are contained in the first Appendix. The tabular material is grouped in the second Appendix with sources and notes explaining methods of estimation added where necessary. The third Appendix deals with some statistical definitions and concepts.

CHAPTER IFACTORS CONTRIBUTING TO THE GROWTH OF CANADIAN
MANUFACTURING INDUSTRIES

"Affluence" in this sixth decade of the twentieth century is usually measured in terms of per-capita income accrued to the inhabitants of a country. Moreover, this "material well-being" is generally associated with a continuous expansion and improvement of industrial processes. In a study dealing with economic growth, such as this, there are therefore two fundamental questions which could be asked: a) What are the forces that have accounted for the development of the industrial sector of the nation? b) Have these factors behaved in an optimum way?

Looking at the second question first, it is obvious that it requires the passing of a value judgement. In a world where private interests differ considerably from social needs, it becomes increasingly difficult to decide "what is best".⁽¹⁾ For these reasons, therefore, any discussion dealing with the normative aspect of economics

(1) See for example the section on Regional and Locational Factors, pp. 26-27.

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will be omitted. In other words, to the extent that the main concern of this thesis is with quantifiable variables, only the first question will be examined.

Industrialization in a more advanced economy, such as the Canadian one, depends upon a considerable number of variables. Among them are:

- a) size of domestic market
- b) natural resources
- c) sources of energy
- d) labour availability
- e) skills and managerial know-how
- f) research, technology and innovations
- g) capital availability
- h) institutional infrastructure
- i) government economic policies
- j) regional and locational factors
- k) foreign investment
- l) foreign trade.

For the remainder of this chapter, these factors will be examined and then one will be chosen for specific

analysis.⁽²⁾

a) Size of the Domestic Market

Even though the above-mentioned variables are not necessarily in order of importance, the first item, size of the domestic market, does carry considerable weight in determining the manufacturing output. In fact, to the extent that exports might be subject to sudden and unpredictable restrictions and changes, the larger and more specialized production units have to be based upon the quantity which could be absorbed internally. For example, in the United States where industrialization has been most successful, gains from mass production have been possible mainly because of large domestic demand. Naturally, the size of the home market does not automatically insure optimal production for any given good, imports could still be better priced. This latter possibility may arise when the domestic market is supplied by a relatively large

(2) Chenery, in his analysis of industrial growth, incorporates changes in demand and supply conditions to account for the industrial development of several countries. These, however, are subdivided into "particular factors" and "universal factors". Among the latter ones, which help to explain the uniformity in patterns of growth are: common technical knowledge, similar human wants, access to the same markets for imports and exports, accumulation of capital as the level of income increases, and increase in skills. The "particular factors" are those factors "unique" to the country. (see H.B. Chenery, "Patterns of Industrial Growth", American Economic Review, Sept. 1960, pp. 625 and 626).

number of firms or when the costs of primary products and/or transportation within the country are unnecessarily large.

In Canada, producers are faced with a small market divided among a large number of firms. In fact, because "there is potentially as great a variety of tastes and quality requirements in a market of 15 millions as there is in a market of ten times that size"⁽³⁾, the attainment of gains from scale and specialization is further hampered. In spite of all this, however, the increase in Value Added by manufacture has been significant over the past 45 years. Table 14 in Appendix II shows how this Value Added has risen compared to Personal Disposable Income and Population.

b) Natural Resources

The importance of natural resources on industrial development has provoked numerous discussions in the past. Some economic-historians for example, have gone so far as to analyze their subject according to "resource areas" rather than to "countries", as politically divided.⁽⁴⁾ Other scholars, such as Kuznets, have pointed out that

⁽³⁾ D.H. Fullerton and H.A. Hampson, Canadian Secondary Manufacturing Industry, Queen's Printer, Ottawa, 1957, p. 72.

⁽⁴⁾ W.N. Parker, "Comment" in J.J. Spengler (ed.), Natural Resources and Economic Growth, Resources for the Future, Washington, D.C., 1961.

"the factors that induce formation of reproducible capital adequate as a basis for economic growth are unlikely to be inhibited by an absolute lack of natural resources".⁽⁵⁾

Finally, Kindleberger, using a neoclassical model of growth has suggested a shifting in emphasis from natural resources to capital and technology as industrialization progresses.⁽⁶⁾

In this country, the vast amount of natural resources has induced a faster industrial growth than would have been possible if these resources had not been available. This hypothesis is in fact strongly supported by the "staple theory".⁽⁷⁾ Moreover, according to the Economic Council of Canada, primary industries such as agriculture, forestry, fishing, and mining, (i.e. those industries more closely connected with natural resources) have long been a major factor in the progress of the whole Canadian economy.⁽⁸⁾

⁽⁵⁾ S. Kuznets, "Toward a Theory of Economic Growth" in R. Lekachman (ed.) National Policy for Economic Welfare at Home and Abroad, Doubleday, N.Y., 1955, p. 36.

⁽⁶⁾ C.P. Kindleberger, Economic Development, McGraw Hill Book Co., N.Y., 1965, p. 62.

⁽⁷⁾ The "staple theory" will however be defined and discussed later on in this chapter when examining the importance of "exports" to industrial growth.

⁽⁸⁾ Economic Council of Canada, First Annual Review, Queen's Printer, Ottawa, 1964, p. 134.

Dr. W.H. Dean has emphasized the importance of "food resources" in industrial development. He suggests in fact that when location theory and relative mobility are considered, the bulkiness and weight of food can severely hamper the process, or even the beginning of industrialization. The lack of raw materials may be overcome by bringing into the region semi-processed, highly mobile raw materials, but not so for food.⁽⁹⁾ In this respect, Canada has enjoyed a considerable advantage.

c) Sources of Energy

Closely connected with natural resources are the sources of energy. In this era of mechanization, the need for adequate supplies of hydroelectric power, petroleum products and coal is obviously very great. As a reflection of this rise in industrialization, energy consumption has risen considerably over the years as shown in Table 1, page 7.

It should be noted that as energy cost continued to increase, a strong incentive to economize in the use of energy has shown up. But the rising cost of power has also created a market for new sources of energy which spurred on the development of petroleum and natural gas fields, and

(9) Quoted in: J.H. Dales, Hydroelectricity and Industrial Development in Quebec, 1898-1940, Harvard University Press, Cambridge, Mass., 1957.

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Table 1

VALUE ADDED BY MANUFACTURE, VALUES OF FUEL AND ELECTRICITY
CONSUMED IN THE MANUFACTURING INDUSTRIES (CURRENT
DOLLARS) CANADA, SELECTED YEARS 1926-1960.

YEAR	VALUE ADDED BY MANUFACTURE Million dollars	VALUE OF FUEL Million dollars	VALUE OF ELECTRICITY Million dollars
1926	1,305	56.7	26.2
1929	1,755	60.4	37.8
1933	920	33.5	33.1
1937	1,509	59.6	50.0
1939	1,531	57.1	50.5
1944	4,016	137.9	87.7
1946	3,467	127.2	83.3
1948	4,939	209.1	94.5
1953	7,444	259.2	152.6
1956	9,605	333.3	190.6
1957	9,882	355.5	199.8
1958	9,792	328.2	211.2
1959	10,221	326.1	216.0
1960	10,550	308.9	226.9

Source: Data are from General Review of the Manufacturing Industries of Canada, 1960, Dominion Bureau of Statistics, 1964, p. 29 and pp. 122-123.

produced innovation in the use of atomic and solar energy. This fact has helped the further industrialization of Canada in two ways. First of all, the greater need for sources of energy by other countries has stimulated the growth of those Canadian industries producing them. Secondly, as the supply of energy at home is rapidly increased, the cost of acquiring it for domestic companies becomes considerably lower, thus reducing further the costs of production and rising profits and eventually industrial output.

J.H. Dales, in assessing the impact of hydro-electricity to "central Canada" (i.e. Ontario and Quebec), on the basis of location theory, suggests that these two provinces (in 1949) had about 60% of the material requirements for the development of "light" industries and thus easily met the criterion of adequacy for industrial growth.⁽¹⁰⁾ Caves, finally, points out the high correlation between energy consumption and national product on the data 1926-1952.⁽¹¹⁾

(10) J.H. Dales, op. cit., pp. 168-180. (By "light industries", he means all industries excluding the "basic industries", where the latter are those transforming natural resources into raw materials). Note: the 60% value is on the assumption that the region has good food resources, excellent forest resources and much of its own requirements of other raw materials.

(11) R.E. Caves and R.H. Holton, The Canadian Economy, Harvard University Press, Cambridge, Mass., 1961, p. 473.

d) Labour Availability

Labour has played and still plays a role of primary importance in the development of the industrial sector of a country. This stems from the fact that labour exerts considerable weight in both the demand and supply sides of the manufacturing equation, i.e. as a buyer of manufactured goods and as a factor of production.

Labour is a function of many variables. That is, it depends on the quantity of the labour force available, which in itself is a function of population change and its willingness to work. Also, the number of working hours, the age and sex composition, and training and education, further determine the role of labour in a dynamic economy.

In Canada, N.H. Lithwick has examined the changes in quantity and quality of labour for the three decades 1926-1956.⁽¹²⁾ Quantitatively, beside a considerable increase in the birth rate (50%) and a moderate decline in the death rate (10%), net migration accounted directly for 13% of the population increase in this period. Qualitatively, the change in age-sex composition has deteriorated the labour force slightly; the growing educational background, on the other hand, has operated in the opposite

(12) N.H. Lithwick, "Labour, Capital and Growth: The Canadian Experience", in: Growth and the Canadian Economy, Carleton University, Ottawa, 1965, pp. IV-1 to IV-9.

direction. "The net result of these two quality changes has been a slight rise in the growth rate of adjusted man-hours to 0.78% per year". (13)

e) Skills and Managerial Know-How

Education, as shown above, improves skills and managerial know-how; these further affect the quality of labour in a positive way. Investment in "human capital" has thus become a very important variable of the growth process. As the First Annual Review of the Economic Council points out, natural resources have always been available, but they had no value until the appropriate knowledge and techniques had been developed for their processing and marketing. Moreover, the dramatic industrial recovery of the post-war of nations which suffered great physical damage would not have been possible without the backlog of knowledge and skills available. (14)

(13) N.H. Lithwick, op. cit., p. IV-9. Note: If only the industrial sector would have been analyzed, it seems that the "net quality improvements" would have been much higher. In fact, not only has industry not been subjected to radical changes in age-sex composition (as for example, the services); but also, the increase in vocational schools, managerial training, etc. has affected mostly the industrial sector. For a more complete discussion on quality changes see: E.F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us. Supplementary Paper of the Committee for Economic Development, New York, 1962, pp. 35-87.

(14) Economic Council of Canada, First Annual Review, Queen's Printer, Ottawa, 1964, pp. 160-162.

The Second Annual Review has also devoted considerable space to the educational problem in Canada especially in its relation to economic growth vis-a-vis the United States.⁽¹⁵⁾ According to this study, "in the neighbourhood of one quarter of the increase in real per capita income over this period [i.e. Canada, 1911-1961] is attributable to the increased educational stock in the labour force".⁽¹⁶⁾

f) Research, Technology and Innovations

Scientific progress, research, innovations and technological change, are complex processes with significant implications for the pace of industrial growth. Schumpeter has analyzed the sequence of technical change in terms of two factors: invention and innovations.⁽¹⁷⁾ While invention was the creative act of insight, innovation made a new product or process economically viable. In other words, research created the environment for inventions; the latter induced innovations which then gave

(15) Economic Council of Canada, Second Annual Review, Queen's Printer, Ottawa, 1965, pp. 71-95.

(16) Ibid., p. 92. Note that the USA has done considerably better, accounting for more than two fifths of the growth of the real per capita income of the male labour force in the United States over the same period. Here, real per capita is assumed to reflect closely the changes in labour productivity and hence the rise of industrialization.

(17) J.A. Schumpeter, Business Cycles, McGraw Hill Book Company, New York, 1964.

rise to technological change.

As men have acquired the ability of applying thought and experiment to the attainment of human ends and have systematically exploited the possibilities of pure science and technology, a steady flow of new methods, new design, and new products has resulted. The vast majority of people have accepted technological change as beneficial. They have recognized that it has led to better working conditions, shortening of working hours and a continuous flow of improved products. On the other hand, technological change has raised fears and concern over the harmful consequences of more polluted air and water, urban congestions, the rapid depletion of natural resources, and the possibility of increased unemployment. But, as human resources have been released and made available for new activities beyond those that are required for a mere subsistence, new horizons have opened up for the creation of additional institutions for the betterment of society.⁽¹⁸⁾

(18) Technology and the American Economy, Report of the National Commission on Technology and Automation, Vol. 1, Feb. 1966, U.S. Government Printing Office, Washington, D.C., 1966. This publication discusses most of the aspects of innovations and technological change quite extensively. The social and private aspects are examined. The statistical tables showing these changes however, apply only to the United States' economy. See also, Science, Economic Growth, and Government Policy, Organization for Economic Cooperation and Development, Paris, 1963.

The dynamic aspect of research and its economic significance can also be looked upon from the effects that it has on the productive capacity and on the level of economic activity that it generates. This "dual effect", similar to the one of "income" as suggested by E. Domar in the growth model, can be easily seen.⁽¹⁹⁾ In fact, through the proper use of scientific and technological research, the efficiency of plants has been raised, the productivity of labour increased, costs reduced by use of better equipment, methods of production improved, and materials used more economically, (that is, an increase in productive capacity). Also, discoveries and inventions resulting from research have contributed heavily to the emergence of such major industries as railroad, automotive, chemical, radio and television, the impact of which has influenced considerably the expenditures of the nation (i.e. an increase in the demand side).⁽²⁰⁾

Canada has benefited materially from research and technological change. To the extent that "per-capita income" reflects the increase in productivity associated

(19) E.D. Domar, Essays in the Theory of Growth, Oxford University Press, London, 1957.

(20) The ideas presented in this paragraph are discussed in a pamphlet of the Department of Reconstruction and Supplies, Research and Scientific Activity, Canadian Federal Expenditures, 1938-1946, King's Printer, Ottawa, 1947, pp. 6-11.

with the development of technology, Table 14 can be used to assess the effects of these changes. Strangely enough, however, there has not been a close correlation between research and development expenditures in this country and economic growth.⁽²¹⁾ Perhaps, the closeness of Canada to the U.S.A. has made possible the acquisition of technological innovations through licensing agreements as direct access to Canadian subsidiaries to the American parent companies. On this subject, however, the Minister of Industry of the Canadian Government has stated that any industry which is dependent upon licensed or imitated design will always lag behind the state-of-art by at least one generation and it is at an obvious disadvantage in export markets, quite apart from competing (at home and abroad) directly with the licensor.⁽²²⁾

Judging the different interpretations given to the role of scientific progress, research and innovation in Canada, it can be said that this nation has at an earlier period of its development relied heavily on imported know-how. In more recent times, especially since the end of

(21) H.E. English, "Growth--The Implication of Institutional Factors" in: Growth and the Canadian Economy, Carleton University, Ottawa, 1965, p. VII-28.

(22) "Secondary Industry and the Place of the Canadian Economy in a Changing World", address by Hon. C.M. Drury to the Marketing Association of Canada, Montreal, 1964, p. 5.

World War II, Canada has substantially increased its scientific capabilities and acquired a large number of well-trained scientists. This effort of Canadian industries, universities and research institutions has been facilitated by fiscal incentives offered by the Federal and Provincial Governments designed to encourage technological advancements in this country.

g) Capital Availability

In a theory of industrial development, capital accumulation occupies a central position. In the Harrod-Domar model, for example, the process of capital formation is interacting and cumulative: capital formation increases income, which makes possible more capital formation. (23)

The construction of a criterion for a choice of investment projects requires a modification of the above mentioned model. It is necessary to abandon the idea that inputs other than capital are free of cost and to rely on the marginal productivity of capital which takes into account the relative contribution of other factors. If it is calculated by discounting the stream of future benefits, V_p , and the stream of future costs of other factors, C_p , it becomes: $\frac{V_p - C_p}{K}$, where K is the amount of capital. This

(23) R.F. Harrod, Towards a Dynamic Economics, St. Martin's, New York, 1948, and E.D. Domar, "Capital Expansion, Rate of Growth and Employment", Econometrica, April 1946.

marginal productivity of capital will serve as a criterion for investment so long as $\frac{V_P - C_P}{K}$ is greater than the rate of interest. (24)

The theoretical "concept of capital" includes inventories, fixed and working capital, social and institutional capital, and consumer's durable goods. Some of these types of capital are not productive in the same sense as fixed capital goods owned by industries, their connection to industrial development being also very significant.

Canadian industrial growth, according to Hood and Scott, has been characterized by a desire or need of Canadian residents to set aside a large proportion of the Gross National Expenditure--between 20 and 25 per cent, for the years 1920 to 1955--for the purpose of capital formation. (25) Furthermore, the ratio of industrial capital to output over the last four decades has remained relatively constant. (26)

(24) C.P. Kindleberger, Economic Development, McGraw-Hill Book Co., New York, 1965, pp. 83-103. This author is aware of not having done full justice to the discussion of the role of capital to economic development. It was felt, however, that a more complex analysis would have been beyond the scope of this thesis.

(25) Wm. C. Hood and A. Scott, (see footnote (23)).

(26) As Hood and Scott suggest, "indeed, we believe that the capital output ratio is an approximately constant ratio in the long run in a growing economy..." (Ibid., p. 45) - See Appendix II for data on Business Gross Fixed Capital Formation for the years 1920-1965.

h) Institutional Infrastructure

Industrial development has been discussed up to now in terms of wealth, labour force, and output; all real factors. There are, however, other equally important aspects which deserve examination. These are concerned with the institutional infrastructure of the economy.

h.1) Financial Institutions have supplied funds and services to the industrial sector of the nation. These funds have supplemented the already existing sources of financing such as: equities (amounts put down by investors borrowing from sources other than financial intermediaries), accumulated earnings (profits after taxes), and capital costs and depreciational allowances. To the extent that funds made available by financial intermediaries, according to the hypothesis of Gurley and Shaw, have speeded up the rate of economic growth, then manufacturing, by making extensive use of these institutions, has provided an additional force for the economic progress of this nation. (27)

(27) In fact, "the rise of intermediaries does not affect at all the basic equalities in a complete social accounting system between budgetary deficits and surpluses, purchases and sales of loanable funds, or accumulation of financial assets and debt. But total debt, including both the direct debt that intermediaries buy and the indirect debt of their own that they issue, rises at a faster pace relative to income and wealth than when finance is either direct or arranged internally". See J.G. Gurley and E.S. Shaw, "Financial Aspects of Economic Development", American Economic Review, Vol. XLV, No. 4, Sept. 1955, p. 519. For statistical data applying to the Canadian Case, see Wm. C. Hood, Financing Economic Activity in Canada, Queen's Printer, Ottawa, 1959, and, Report of the Royal Commission on Banking and Finance, Queen's Printer, Ottawa, 1964.

h.2) Transportation and Communication. Economic efficiency requires an extensive network of transportation and communication facilities. As long as two centuries ago Adam Smith suggested that "good roads, canals and navigable rivers, by diminishing the expense of carriage, put the remote parts of the country more nearly upon a level with those in the neighbourhood of the town" thus increasing competition toward an optimum allocation of resources.⁽²⁸⁾ Canada, by the very nature of its geographic location, the great distance between its extremities and the vast stretches of relatively unproductive areas between its settled areas has been a difficult country for which to furnish transportation. Yet, in a comparative short space of time it has been provided with two large railway systems, an extensive canal route and a rapidly developing system of air transport. All of this has further contributed to industrialization.⁽²⁹⁾

(28) A. Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, Ed. Cannan, Modern Library, New York, 1937, p. 147.

(29) The Royal Commission on Transportation, Queen's Printer, Ottawa, 1951. For more recent discussions and statistics, see J.C. Lessard, Transportation in Canada, Queen's Printer, Ottawa, 1956, and F.W. Anderson, "Research and Public Policy Issues: Some Canadian Comparisons" in Transportation Economics, National Bureau of Economic Research, New York, 1965, pp. 439-451.

h.3) Others. There are other factors of importance in the institutional infrastructure of this country which have helped considerably in the Canadian industrial development. They include: availability of capital via the stock market, quality of professional services (i.e. legal, accounting, engineering, etc.), access to advertising and the news media, and finally an adequate and stable system of government.

i) Government Economic Policies

i.1) General Policies. The impact of governmental actions on industrialization requires a deeper examination, especially in view of the present trend toward the welfare state. H.E. English subdivides the effects of government policies into two categories: effects on supply conditions and effects on demand conditions.⁽³⁰⁾ The first includes all those actions tending to increase or decrease the supply of goods, the latter referring to those policies which affect the demand conditions. In Canada, governmental policies that are cost-raising or demand-decreasing have included all forms of commodity taxation (such as the general sales tax, excise tax, and all customs duties), and controls which may limit supplies of a variety of

(30) H.E. English, "The Pervasive Effect of Government Policy", in Canadian Economic Policy, MacMillan Co. of Canada, Ltd., 1965, pp. 3-27.

products--for example the financial services and controls of the Bank of Canada and the public transportation system. There are other activities of the government which have assisted in reducing the costs of some industries. These include direct subsidies, the accelerated depreciation provision in the corporate income tax laws, and expenditures in research efforts.

Demand conditions have been affected by any government policy which has altered the consumer's pattern of wants or the amount of income he has received. Among these factors are the government's major expenditure categories, defence, and health and welfare, and a variety of specific demand controlling or promoting measures such as cut or increase in personal income-tax and "moral suasion" in favour or against certain particular products.

i.2) Commercial Policies. For a country with highly specialized resources and a substantial dependence on international trade, commercial policy--that is, policy directed toward influencing the extent and nature of a country's foreign trade--is certainly of considerable importance. There are a variety of practices covered by the commercial policy label: tariffs, quotas, exchange controls, and other administrative practices. Some of these involve the reduction of competition from abroad for local producers, others might even cut imports completely

so as to assure a market only for domestic suppliers. In Canada, the most important method of trade restriction is the tariff; its impact upon the economy will now be briefly examined.

A tariff is an effective means of improving the tariff-imposing country's terms of trade, protecting the import-competing industries, and raising the real earnings of the factor used relatively intensively in producing importables.⁽³¹⁾ In a study prepared for the Royal Commission on Canada's Economic Prospects, Hood and Scott note that in spite of fluctuations in periods of depression and boom, this country's terms of trade over the longer term have remained relatively constant.⁽³²⁾ This fact can be explained in terms of Canada constantly changing the composition of her production so that the prices of her exports have not lost ground in the race with the prices of goods which she imports. It could also be

(31) If, however, the shape of the foreign offer curve is inelastic, these objectives are likely to be contradictory. For then the terms of trade may improve so much that the domestic price of import falls in the tariff-imposing country, with a consequent reduction in the domestic production of importables and a redistribution of earned income towards the factor used relatively intensively in producing exportables. (See, L.A. Metzler, "Tariffs, the Terms of Trade and the Distribution of National Income", Journal of Political Economy, February, 1949, pp. 1-29).

(32) Wm. C. Hood and A. Scott, Output, Labour and Capital in the Canadian Economy, Queen's Printer, Ottawa, 1957, pp. 72-75.

explained by Canadian tariffs having been (or being) imposed on a quid pro quo basis; i.e. terms of trade deterioration due to other countries' imposition of tariffs having been balanced by a similar move in Canada and vice versa. Nevertheless, this latter hypothesis is partly refuted in the following paragraph.

Professor Young, in a Royal Commission Study has analyzed the historical as well as the financial aspect of Canadian tariffs.⁽³³⁾ Several points have been raised in this publication. There are two areas, however, that deserve closer examination. The first one is related to the remarkable stability of the Canadian tariff during the course of the last century. In fact, there have been only three occasions in which the tariff has been significantly increased (i.e. 1858-59, 1879 and 1930-31) when the country was undergoing a depression or just emerging from one. Reductions, on the other hand, were usually spread over longer periods of time. The second one is concerned with the effect of the tariff on Canadian prices. This is done by calculating the difference between the amount spent in purchasing the products of protected industries and the amount which the same quantity of goods would have cost at world prices. However, if this procedure is compared with the one suggested by H. Johnson, the former seems to give

(33) J.H. Young, Canadian Commercial Policy, Queen's Printer, Ottawa, 1957.

results somewhat more inflated.⁽³⁴⁾ Also, the estimates relate only to the private sector of the economy, and to the extent that government expenditures are generally directed towards domestically produced goods, then this could be a serious omission. The estimated "cash-cost" of the Canadian tariff in 1954 was about 0.7 billion dollars or about 4% of the total growth of private expenditures net of taxes. Whether this is the right price paid by Canadians in exchange of the services offered by the tariff is still an open question.⁽³⁵⁾

Looking now at the individual industry's level, rather than at the aggregate, the commercial policy seems to divert resources into domestic industries which may have higher costs than the foreign ones, and also may under certain circumstances foster monopolistic or oligopolistic industrial structure and control of the market. According to Dr. H.E. English, tariff contributes to one of the following resource misuse:

If all available efficiencies of scale are in effect, the firms are all enjoying excess profit through higher prices and lower output made possible by the tariff. In this situation, the industry is in no way dependent upon protection. If the margin of protection provided

(34) H.G. Johnson, "The Cost of Protection and the Scientific Tariff", Journal of Political Economy, October, 1960.

(35) "Services of the tariff" mean among other things, the protection of infant industries, and the bargaining powers for quid pro quo negotiations.

is fairly large and the number of Canadian producers not too few, perhaps eight or ten, this situation sometimes involves a price set significantly below the foreign supply price plus tariff.... Where some or all of them are able to operate with production units which are less than ideal, resources are being wastefully used.(36)

This issue of economies of scale is of particular importance for foreign-owned companies. Why should a tariff be needed to achieve economies of scale, when greater output could be obtained simply by diverting export orders from the U.S. plants, say, to the Canadian subsidiary. Yet, a study by A.E. Safarian suggests that there is little evidence that foreign-controlled firms fail to act in the best interest of Canadian industrial growth, so far as they are able to, in view of their profit maximization requirements, and in view of the existing pattern of trade restrictions.(37) A gradual reduction of tariff restrictions could create the proper environment for an optimum allocation of resources. A study of the economic developments following the recent tariff cuts in Geneva might provide the answer to this difficult problem.

(36) H.E. English, "Resource Allocation and Government Policy", in Canadian Economic Policy, The MacMillan Co. of Canada Ltd., Toronto, 1965, p. 21.

(37) Safarian in his analysis, based on an extensive survey of American owned enterprises in Canada, finds that the degree of foreign ownership has little relation to the size of exports in these industries, and that "problems which inhibit Canadian exports are generally common" to both, foreign-owned and Canadian-owned firms. (See A.E. Safarian, "The Exports of American-Owned Enterprises in Canada", American Economic Review, May, 1964, pp. 449-458.

j) Regional and Locational Factors

One of the most significant elements a theory of economic development deals with is "balanced versus unbalanced growth".⁽³⁸⁾ This topic refers to the way in which an optimum economic expansion might be achieved; in other words, whether few sectors or the economy as a whole should grow at any one period of time. Obviously, this choice is generally not arbitrary, but depends upon the foreign and domestic tastes for the goods produced at home, the natural factors that the country is endowed with and their location, and finally the expected possibilities of forward and backward linkages.⁽³⁹⁾ The same principle of economic subdivisions could also be applied to regional growth, more specifically whether few regions should lead to the national expansion or the country as a whole should progress gradually.

Canada has experienced both types of "unbalanced growth", i.e. at the industrial level with "staple industries", and at the regional level with Ontario, British Columbia and Alberta enjoying the leadership. Examining briefly the "regional differences", the Atlantic provinces have made the slowest progress, mainly because of lack of

(38) A.O. Hirshman, The Strategy of Economic Development, Yale University Press, New Haven, 1963.

(39) Ibid., pp. 98-116.

natural resources. This fact has led to a persistent migration of skilled labour to the richer regions causing an even wider differential in per capita income and therefore growth.

The Canadian Government has in the past hesitated to commit itself on the issue of industrial location. One of the reasons for this can be found in the constitutional divisions of responsibilities which makes industrial development largely a provincial matter under Section 92 of the British North America Act.⁽⁴⁰⁾ More recently, however, there has been an understandable change in attitude. In the Budget Speech of June 1963, the Minister of Finance stressed the importance of directing new investments, wherever practicable, to areas of slower growth and surplus manpower.⁽⁴¹⁾ Furthermore, the Economic Council of Canada emphasized, in Chapter V of the Second Annual Review, the crucial importance of achieving fuller utilization of resources and more rapid gains in productivity in the lower income regions.

The conflict between private and social interests is rather deep and difficult to solve.⁽⁴²⁾ In fact,

(40) Sub-section 10.

(41) Quoted in T.N. Brewis, "Regional Development" in Canadian Economic Policy, p. 320.

(42) As already mentioned in page 1 of this thesis.

industries located in areas of slow growth, even though serving an important social objective, might not succeed to operate at optimum efficiency. The cost of misallocation of resources could be greater than the benefits provided to the region.

Attempts to bolster declining industries and areas without regard for their future viability is one of the less promising ways, in the long run, of aiding the people associated with them. No better illustration of this can be found than the prolonged heavy subsidization of the Nova Scotia coal industry.⁽⁴³⁾

Regional differences can thus be beneficial to industrial growth only if there is a continuous effort to close the gap. In other words, unbalanced growth is useful only if there are strong linkages between the regions, so that the lagging ones can catch up with the leading regions at a faster rate than would otherwise be the case, (i.e. lagging regions in an attempt to narrow the per capita income differential between them and the leading regions will try to grow at a faster rate than the leading regions).

k) Foreign Investments

The theory of international capital movements has been generally concerned with the mechanism of adjustments in the balance of payments. In discussing industrialization, however, this theory should be examined in the light of the impact which international investments have on the

(43) T.N. Brewis, "Regional Development", op. cit., pp. 321-322.

development process itself. Even though as Nurkse has emphasized, there is still need for "a theory of capital movements, that is concerned with capital as a factor of production" and which would direct attention "to the relations between capital movements, population growth... and to other such fundamental matters",⁽⁴⁴⁾ yet, an analysis could be made on the basis of costs and benefits of foreign investments.

There is a national economic gain from capital imports if the value added to output by foreign capital is greater than the amount appropriated by the investor: social returns then exceed private returns.⁽⁴⁵⁾ This is the case, for example, if the capital added increases the productivity and/or the amount of the labour force employed. One of the benefits of foreign investments arises from external economies. The main reason is that direct investments bring to the recipient country not only capital, but also technical personnel, technological knowledge, and innovations in products and production techniques, and at times also assurances of markets, e.g. the promise of minimum markets of 10 million tons of iron per annum for twenty years given by five American steel companies, led to U.S. development

(44) R. Nurkse, Problems of Capital Formation in Underdeveloped Countries, Blackwell, Oxford, 1953, p. 131.

(45) G.M. Meier, International Trade and Development, Harper and Row, New York, 1963, pp. 92-96.

of the iron ore deposits in Labrador. On the other hand, there is rising concern that this type of investment might lead to a rapid depletion of Canadian natural resources.

The foregoing mostly beneficial effects should be examined against the following costs. First of all there are adverse effects on domestic savings. To the extent that a rise in productivity increases the earnings of the low income groups and decreases the returns to capital, foreign investment reduces the country's marginal propensity to save.⁽⁴⁶⁾ Secondly, depending upon the income elasticity of foreign produced goods, the economic structure of the receiving country and its productive capacities, the terms of trade might be adversely affected by an inflow of capital. Finally, there are the effects upon the balance of payments. In fact, "if the transfer mechanism does not operate rapidly and smoothly, a disequilibrium will persist in the balance of payments of the lending and borrowing countries".⁽⁴⁷⁾ This disequilibrium may be due either to the secondary effects of capital movements in inducing more imports in the borrowing country, because of the raising in domestic spending, or, to a continuous outflow to provide adequate servicing of the foreign debt.

Up to now Canada has not been able to provide enough capital from its own resources to finance the rapid

(46) Ibid., pp. 96-97.

(47) Ibid., p. 99.

development of the country's industries. The Final Report of the Royal Commission on Canada's Economic Prospects has analyzed the historical pattern of investments with respect to the proportions of direct and long-term capital investment as well as to the geographical origin of such inflows.⁽⁴⁸⁾ Recent publications show the increasing amounts of foreign capital entering Canada and the larger share of American investment compared to that of other countries.⁽⁴⁹⁾

Reasons for this rise in foreign investment are to be found not only in the increasing needs of Canadian industries, but also because the "investment climate" in Canada has been favourable. In fact "Canada has also had a long history of orderly and responsible government... hard working people with a strong desire for material advancement, a skilled labour force, a well developed education system, adequate transportation and other social-capital facilities".⁽⁵⁰⁾ This provided great opportunities for profits at relatively small risks. There is also,

(48) The Royal Commission on Canada's Economic Prospects, Final Report, Queen's Printer, Ottawa, 1957, pp. 380-383.

(49) See for example D.W. Slater, "Capital Flows into Canada", The Canadian Banker, Winter, 1963.

(50) The Royal Commission on Canada's Economic Prospects, Final Report, pp. 385-388.

insofar as resource industries are concerned, the desire to develop and guarantee sources of supply of materials for which the needs of the United States and the world are, or promise to be, greater than can be supplied from existing resources. Finally, the motive for direct investment by non-residents in the manufacturing industries has been to expand the parent companies' operations into the Canadian market.

The effects of foreign capital seem to be economically beneficial even though, as some sources claim, they seem politically objectionable. Professor Slater in examining the capital flows into Canada suggests that the increased availability and use of foreign capital will contribute to a rise in the "potential" economic growth.⁽⁵¹⁾ R.G. Penner, in a recent paper attempts to measure quantitatively the importance of foreign capital in Canada.⁽⁵²⁾ On the assumption that capital inflows are entirely transformed into real capital stocks, he estimates that in 1956 GNP would have

(51) D.W. Slater, "Capital Flows into Canada", The Canadian Banker, pp. 14-16. Note: "potential" growth means the increase in output which would take place if affairs could be arranged so that full and continuous use could be made of all available manpower, capital, resources, knowledge, and organizational arrangements. Here then, capital inflow would not only increase "actual" (in the Harrodian sense) growth, but also "potential" growth.

(52) R.G. Penner, "The Benefits of Foreign Investment in Canada, 1950 to 1956", Canadian Journal of Economics and Political Science, pp. 172-183.

been $3\frac{1}{4}\%$ lower if foreign capital had been excluded from the country. (53)

A possible long-run political implication of the impact of foreign capital on the industrial sector and on the whole economy is raised in the following quotation: "There is concern that as the position of American capital in the dynamic resource and manufacturing sectors becomes even more dominant, our economy will inevitably become more and more integrated with that of the United States." (54) Eventually this might lead to a complete economic integration between the U.S.A. and Canada.

1) Foreign Trade

All the items examined here earlier have in one way or another stimulated or affected the growth of the manufacturing industry in Canada. There remains, however, an additional factor which has been discussed extensively by leading economists mainly in connection with modern underdeveloped countries, but which is of considerable importance in reviewing this country's industrial growth. This factor is foreign trade.

(53) However, under the assumption that technical change does not depend directly upon changes in the stock of capital, the advantage of foreign investment falls to 1.4 of the 1956 Canadian Gross National Product.

(54) Royal Commission on Canada's Economic Prospects, Final Report, quoted in W.L. Gordon, Troubled Canada, McClelland and Stewart, Ltd., 1961, p. 92.

Classical and neoclassical economists in discussing the impact of foreign trade upon development have considered trade not as a device for achieving productive efficiency, but also as "an engine of growth".⁽⁵⁵⁾ This is because as a country specializes according to its comparative advantage and trades, it gains an increase in real income. Yet what could happen is that even though there is an optimum allocation of resources and maximization of the gains from trade for every short-run period, in the long run the growth might have indeed been inefficient.⁽⁵⁶⁾

Professor Kindleberger in his Foreign Trade and the National Economy has examined in a scholarly fashion the various issues associated with foreign trade and growth.⁽⁵⁷⁾ Some of the ideas expressed in this publication are examined in the following paragraphs.

Trade, and in particular exports, can affect industrial growth in three different ways depending upon the particular country or situation: they can lead, balance, or lag behind the other sectors of the economy. Starting

(55) G.M. Meier, International Trade and Development, p. 152. Among the dissenters of this optimistic view are List, Manóilesco, Prebisch and Myrdal.

(56) Ibid., p. 154. It has been demonstrated that perpetual one period efficiency can be inefficient over the long run. See, G.M. Meier, op. cit., p. 154, note 4.

(57) C.P. Kindleberger, Foreign Trade and the National Economy, Yale University Press, New Haven, 1962, pp. 195-211 (see also pp. 177-194).

with the latter type, it is the view of several economists such as Prebish, Myrdal, and Singer, that industrial domestic growth must begin without excessive reliance on exported commodities. (58) Under these circumstances, trade expansion depends upon the availability of agricultural products, as Nurkse suggests, to counteract the increase in imports of capital goods at the expense of consumers' goods. (59) In the presence of loans or aid then capital goods can be paid for. In this case, however, the increase in income available to the residents of the country, might have good or bad consequences depending on whether the additional money will induce a rise in output in other domestic industries or a rise of imports.

The second model deals with trade as a balancing sector. Naturally, if the changes in stock are ignored, "trade is always a balancing sector in the sense of filling the gap between production and consumption". (60) The important point here is the following: specialization in only one product at the time might be impossible for the lack of a considerable domestic market, the opportunity of

(58) Ibid., p. 208. The source of Prebish, Myrdal, and Singer publications are given by Kindleberger in op. cit., p. 208, footnotes 24, 25, and 26.

(59) R. Nurkse, Patterns of Trade and Development, Wicksell Lectures, Stockholm, 1959.

(60) C.P. Kindleberger, Foreign Trade and the National Economy, p. 205.

supplying both internal and foreign buyers might make the production of such good economically possible.⁽⁶¹⁾ Lewis and Nurkse put forward a particular version of the balancing case by suggesting a trade pattern based on exporting manufactures in order to import food and take the strain off domestic agriculture.⁽⁶²⁾ In this model, then, exports as well as imports generally increase with industrialization.

The third model is of considerable interest to this country's industrial development because it has been put forward by H. Innis as an attempt to explain Canadian economic growth. According to this theory (i.e. the "staple theory"), staple exports are the leading sector of the economy and set the pace for economic growth.

The limited--at first possibly non-existent--domestic market, and the factor proportions--an abundance of land relative to labour and capital--create a comparative advantage in resource-intensive exports, or staples. Economic development will be a process of diversification around an export base. The central concept of the staple theory, therefore, is the spread effects of the export sector, that is, the impact of export activity on domestic economy and society.⁽⁶³⁾

(61) The typical case is Japan where exports did not lead growth but provided close support.

(62) See W.A. Lewis, The Theory of Economic Growth, R.D. Irwin, Inc., Homewood, Ill., 1955; R. Nurkse, Patterns of Trade and Development.

(63) M.H. Watkins, "A Staple Theory of Economic Growth", Canadian Journal of Economics and Political Science, May, 1963, p. 144.

In order to assess the spread effects, their determinants must be indicated. According to M.H. Watkins the important determinant is the technology of the industry, i.e. the production function which defines the degree of factor substitutability and the nature of returns to scale also of interest are: the demand for factors and intermediate inputs, the possibility of further processing, and the distribution of income. The process of industrial growth, then, is the following:

If the demand for the export staple increases, the quantity supplied by the new country will increase. This export expansion means a rise in income in the export sector. The spending of this income generates investment opportunities in other sectors, both at home and abroad. By classifying these income flows, we can state the staple theory in the form of a disaggregated multiplier-accelerator mechanism. In Hirshman's terms, the inducement to domestic investment resulting from the increased activity of the export sector can be broken down into three linkages effects: backward linkage, forward linkage, and we shall call final demand linkage.⁽⁶⁴⁾

(64) Ibid., p. 145. Here "backward linkage" is a measure of the inducement to invest in the home production of inputs, for expanding export sector. Theory and history suggest that the most important example of this linkage is the building of transport systems for collection of staple. "Forward linkage" is a measure of the inducement to invest in industries using the output of the export industry as an input. The example here, is the increasing value added in the export sector due to possibilities of further processing. "Final demand linkage" is a measure of the inducement to invest in domestic industries producing consumer goods for factors in the export sector.

This "staple theory" model together with Mynt's "vent for surplus" model have been recently examined by R.E. Caves.⁽⁶⁵⁾ These two models, according to Caves, share an essential characteristic in that they depict the effects of trade on growth as involving the exploitation of resources lacking, in that place and at that time, any alternative uses of significant economic value. Moreover, "the pace of growth and the changes in the pattern of international trade associated with the absorption of such resources, gives these models their distinctive stamp, in contrast to models involving resource allocation ...".⁽⁶⁶⁾

In discussing both factors, trade and industrialization, it was pointed out above that this is a two-way relationship. In other words, industrial development can affect and be affected by the level of trade. Sombart for example, has formulated a law of the declining importance of trade with industrial growth. Kuznets, on the other hand, has suggested that there is not a prevalence of trend in one direction. Engel's law, finally states that domestic production will grow at a faster rate than imports, as industrialization proceeds, if the latter consist of foodstuffs or simple materials, while the former comprises more complex types of articles.

(65) R.E. Caves, "Vent for Surplus: Models of Trade and Growth" in Trade, Growth and the Balance of Payments, Rand McNally and Company, Chicago, 1965.

(66) Ibid., p. 96.

Two additional points should be made in connection with imports and industrialization. The first one of Hirshman says that, in general, an increase in imports precedes the establishment of a domestic industry by demonstrating the existence of a market. The second one by Chenery suggests that equilibrium in the process of industrial growth is achieved when import substitution fills the gap between production and domestic demand.(67)

The effects of industrial growth on trade seem therefore to be mostly reflected by changes in imports. This hypothesis is further reinforced by the Harrod-Domar model, stating that the expansion in capacity (i.e. exponential growth) increases the possibility of exports, but the major effect is the rise in incomes (of the residents of the country) which spills over into imports. This latter hypothesis however, is refuted by the Abramowitz-Solow model, which says that even though there is a rise in incomes that causes an increase in imports, the major effect of growth (i.e. expansion in capacity and associated with it of technological change) is an expansion of exports.(68)

This Chapter has dealt with some of the major

(67) C.P. Kindleberger, Foreign Trade and the National Economy, Chapter 11.

(68) The Harrod-Domar and Abramowitz-Solow models are discussed in C.P. Kindleberger, op. cit., pp. 192-194 and 209-210.

factors influencing industrial growth. The extent to which each factor is specifically responsible for the development of Canadian industries is hard to determine. However, it seems that on the basis of the evidence present in this Chapter, and in view of Canada's unique position (i.e. geographical, as well as social and political) the foreign sector of the economy, and in particular exports, have played and continue to play a most prominent role in this country's industrial development. These considerations therefore suggest that exports (i.e. total, as well as manufactured goods, exports) should be chosen for deeper examination. (69)

(69) See also, R.E. Caves and R.H. Holton, The Canadian Economy, Harvard University Press, Cambridge, Mass., 1961, pp. 79-80.

CHAPTER II

DEFINITIONS, METHODOLOGY AND DATA

The meaningfulness of an empirical study depends on the choice of the variables to be analyzed. When there are several quantities available for any one analysis, then these quantities should be first defined and then compared in order to make the best possible selection. It is the purpose of the next few paragraphs to perform this definitional-methodological, as well as selective kind of operation.

This thesis, as pointed out above, deals with two basic sets of variables: "output of manufactures", "exports of manufactured goods" and "investments of manufacturing industries", and "output", "exports of goods and services" and "investment" of the Canadian economy as a whole.

Definitions of the variables used at the national aggregate level and their numerical values are found in an unambiguously well-defined way in the National Accounts issues published by the Dominion Bureau of Statistics. Therefore a discussion of such variables has not been included in this chapter. Rather, attention is focused on the manufacturing sector. More specifically on what is

meant by: "manufacturing", "output of manufactures", and "export of manufactured goods".

a) Definition of "Manufacturing"

Even though a formal definition of "manufacturing" does not seem to be available in any official Dominion Bureau of Statistics publication of recent vintage,⁽¹⁾ in practice the D.B.S.'s concept of manufacturing appears similar to that given in the United States Standard Industrial Classification Manual.⁽²⁾ According to this latter publication, manufacturing includes all

those establishments engaged in the mechanical or chemical transformation of inorganic or organic substances into new products and usually described as plants, factories, or mills which characteristically use power-driven machines and materials-handling equipment. Establishments engaged

(1) In the 1901 Census of Canada a manufacturing establishment or factory was described as "any premise, building, room or place where steam, water or other power is used to move or work machinery employed in preparing, manufacturing, or finishing, of any article, substance, material, fabric or compound, or to aid the manufacturing process carried on there, or any premises, building, room or place wherein the employer or the person working there has the right of access and control, and in which any manual work is exercised by way of trade or for purposes of gain in making, altering, preparing, ornamenting or finishing any article or part of article to adapt it for sale". (See Fourth Census of Canada, 1901, Volume III Manufactures, S.E. Dawson, Ottawa, 1905, p. v).

(2) Standard Industrial Classification Manual Executive Office of the President, Bureau of the Budget, U.S. Government Printing Office, Washington, D.C., 1957.

in assembling components parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement. The materials processed by manufacturing establishments include products of agriculture, forestry, fishing, mining and quarrying. The final product of the manufacturing establishment may be 'finished' in the sense that it is ready for utilization or consumption, or it may be 'semifinished' to become a raw material for an establishment engaged in further manufacturing. For example, the product of the copper smelter is the raw material used in electrolytic refineries; refined copper is the raw material used by copper wire mills; and copper wire is the raw material used by certain electrical equipment manufacturers. Printing, publishing, and industries servicing the printing trades are classified as manufacturing industries.⁽³⁾

Upon enquiry, the Dominion Bureau of Statistics advised the writer, that the present definition of manufacturing activity can be deduced from the Standard Industrial Classification Manual. Moreover, a definition of manufacturing per-se does not have much significance because "such definitions have little meaning in themselves and can be given content only with reference to practice (i.e. what constitutes 'assembling' and is it included as a physical transformation)".⁽⁴⁾

b) Output of Manufactures

There are several ways in which "output" of

(3) Ibid., p. 43.

(4) Communication of the Dominion Bureau of Statistics, August 16, 1965.

manufacturing industries could be expressed. The Canadian National Accounts uses two concepts, Net National Income by Industry and Gross Domestic Product at Factor Cost by Industry. The former concept was discontinued after the year 1956; the latter concept was used for subsequent years. However, a series on the Gross Domestic Product is available covering the period from 1926 to the present.

The Net Income concept can be defined for the manufacturing sector as the sum of all the payments made by that industry for the use of the factors of production (i.e. labour and capital, including land) -- wages, salaries, interests, rents and profits before taxes -- and subtracting the interests and dividends received. The Net Income Originating, therefore, takes into account all factors of production on a net basis, avoiding all duplication. The Gross Domestic Product, on the other hand, can be thought of either as the sum of factor incomes and capital consumption allowance paid or charged by the industry, or the difference between revenues (excluding indirect taxes) arising from the production of manufactured goods and expenditures for the acquisition of intermediate goods and services. In other words, the Gross Domestic Product by Industry concept equals the Net National Income by Industry concept plus Capital Consumption Allowances plus (Income Received from

Non-Residents minus Income Paid to Non-Residents). Also the Gross Domestic Product concept eliminates the inter-industry duplication.

The Value Added concept, as per the Dominion Bureau of Statistics Census of Industry, finally, can be defined as Gross Value of Production of the manufacturing industries minus the cost of material, fuel, and electricity used.⁽⁵⁾ This Value Added differs from the National Accounts' Gross Domestic Product in that it includes miscellaneous indirect taxes such as licences and property taxes, and the cost of services such as insurance, advertising, communications, and so forth. Thus, the measurement of the value of output based on value added "although mostly 'net' within the field covered by this report i.e. Survey of Production, 1962, DBS, Ottawa, 1965, contains some duplication if it is used as an approximation of the gross domestic product originating".⁽⁶⁾ Moreover, the Value Added data are mostly based on an "establishment" concept, rather than partly on "establishment" and partly on "company" concepts, and they are, therefore, much

(5) Gross Value of Production is defined as "Shipments plus closing inventory of finished products and goods in process minus the opening inventory of finishing products and goods in process" (General Review of the Manufacturing Industries of Canada, 1960, DBS, Ottawa, 1964, p. 13).

(6) Survey of Production, 1962, DBS, Ottawa, 1965, p. 7.

easier to break down into finer industrial sub-divisions.⁽⁷⁾ Another considerable advantage in using the net value of commodity production series is that the data are available by provinces. Finally, the ratio of Value Added to Value of Factory Shipments has been reasonably consistent in the past, and therefore data for the former variable could be calculated from the latter variable. Value of Shipments statistics constitute, in fact, the latest available estimates for the industrial output.⁽⁸⁾

For short run analysis Value Added data appears then to be a reasonably well-defined and usable quantity. However, for long-run studies, such as this one, there are several disadvantages associated with the Value Added series. In fact, the Value Added series, due to the revision of the classification and concepts in the annual

(7) A "company" might in fact, be composed of several "establishments" each producing goods classifiable under different industrial subdivisions, yet only one total (i.e. for the "company as a whole") would be available. Here, "establishment" is defined as "the smallest unit which is a separate operating entity capable of reporting all the following principal statistics: Materials and supplies used, goods purchased for resale as such, fuel and power consumed, number of employees and salaries and wages, inventories, shipments or sales" (Manufacturing Industries of Canada, 1962, Section A, Summary for Canada, DBS, Ottawa, 1965), section on "Explanatory Notes". Note that a manufacturing establishment might be engaged in other activities in addition to its principal manufacturing activity.

(8) Value of Shipments figures are somewhat inflated, as they are not free of duplications. They should, therefore, be used with caution.

census of manufacturing establishments, has two discontinuities in the years 1960 and 1961. Data for the years 1961-1965 as presented in Table 14, page 121, are only "roughly" comparable to the preceding years. The Dominion Bureau of Statistics has provided two additional comparable series of statistics: the first one, for the years 1957-1960 (inclusive) reflects the changes in "classification"; the second one for 1957-1961, shows the implementation of the new definition of the reporting unit, the "establishment". There has also been an additional third stage which consisted in the extension of the definition of establishment to cover "total activities" but this has added to, rather than changed the available data.⁽⁹⁾ The data for the Gross Domestic Product, on the other hand, are calculated using only the 1948 Standard Industrial Classification. That is, they are free from all distortions arising from recent changes in classification. For this reason, they have been used in all but one current dollar analyses of this thesis.⁽¹⁰⁾

c) Exports of Manufactured Goods

In attempting to describe the movement of Canada's exports of manufactured goods over the past half century,

(9) See, Manufacturing Industries of Canada, 1962, DBS, section on "Explanatory Notes".

(10) The other series used is the Value Added by Manufacturing.

it had not been possible to select one series and to suggest that it necessarily represents the changes which have taken place in that particular sector. Rather it is a combination of two of the three groups of exports according to the Degree of Manufacture that approximates the value exported by the manufacturing industries. Moreover, the discontinuity in the data in 1961 due to a new classification, further accentuated the difficulties to obtain an exactly comparable set of statistics, especially for the separate data of Partially Manufactured and Fully Manufactured goods.

Manufactured goods exports in the new concept of Fabricated plus End Products are somewhat narrower in concept than those of Partially plus Fully or Chiefly Manufactured Goods. This is because asbestos milled fibres and shorts, gypsum, man-made fibres, scrap metals, and waste materials, which were previously considered as partially or fully manufactured goods are now classified as Crude Materials and therefore excluded from the manufactured exports totals. (11)

(11) For clarity of exposition, the definitions of the three new groupings are given here. Crude Materials comprise all commodities, including food-stuff, whose chief use is as materials and which have not been processed beyond the stage of cleaning, sorting or concentrating, or the equivalent operation in the case of synthetics. Fabricated Materials cover those commodities and food-stuffs that have undergone some preliminary processing but which are still used mainly as materials for subsequent processes. End Products, finally, comprise all commodities and food-stuffs which will not lose their identity through further processing and which are usually considered as

It should also be observed that while in essence the definitions given in footnote (11) do not differ greatly from the concepts of Raw Materials, Partially Manufactured Goods and Fully Manufactured Goods because they are all concerned with the state of processing, the following major changes have taken place.

Raw Materials (as per Table 20) do not include asbestos milled fibres, etc. which are however part of Crude Materials as explained in text above. Partially Manufactured Goods (as per Table 20) do not include flour, newsprint, steel rolling mill products, almost all the items in the chemicals and allied product listing and a number of other minor products which are now classed as Fabricated Materials. Fully or Chiefly Manufactured Goods (as per Table 20), finally, include newsprint and other papers, meals and flours, natural and man-made fabrics and a number of chemicals and allied products, etc. which are now excluded from the End Products classification. (12)

Thus, the main differences arise between Fabricated Materials and End Products; that is, within the total value of exports and manufactured goods itself. To the

finished products rather than materials, together with identifiable parts, accessories and attachments in the case of durables. (See, Canada's Commodity Export Trade, 1952 to 1964, Trade and Commerce, Ottawa, 1964, pp. 2-3).

(12) Ibid., pp. 4-5. The distinction between Fabricated Materials and End Product in the 1961 classification requires clarification. A nail and a needle were both considered fully manufactured under the degree of manufacture classification. Under the new classification a nail is considered a fabricated material and the needle an end product because the nail is of use only when incorporated with other materials whereupon it loses its identity; whereas, while the needle is also used with other materials it emerges from that use unchanged and available for the same purpose again.

extent that this study analyzes mainly the aggregate aspects of the manufacturing sector, the impact created by this reclassification has therefore been reduced.

Either one of these series could have been used for the statistical analysis. The choice of the Partially and Fully Manufactured Goods over the Fabricated Materials and End Products was based upon the availability of data. In fact, while for the former series the Dominion Bureau of Statistics has prepared a set of comparable data for the years 1920-1960, for the latter series, only data for the post-war period is available.

d) Constant Dollars Data

The preparation of constant dollars series for relatively long periods of time, such as the one presently analyzed, in general creates considerable problems. In fact, because one system of weights cannot possibly be used for the whole half century, the base year has to be changed one or more times; the linking process becomes gradually more complicated and error-prone, as the set of statistical periods augments. Also, a series might be made up of values expressed in 1913 and 1948 dollars when the base year needed is 1949.

Looking now at the "manufactured output" data, there are several ways of expressing real production. One possibility would be to deflate the Value of Factory

Shipments with the Wholesale Price Index as well as the other components such as fuel, electricity, and cost of materials with suitable indices, and the difference between those two sets would give a real Value Added of the manufacturing industry.⁽¹³⁾ Another possibility would be the product between the index of real domestic products for manufacturing and the appropriate dollar value. Even though in this thesis the two series are included for purpose of comparison, only the latter is used in the empirical analysis. This series was chosen because of the availability of a quantity index prepared by the Dominion Bureau of Statistics and covering practically the whole period analyzed in this study.

Examining the foreign trade data in constant dollars, the values for the aggregates and certain subdivisions are "believed to be reasonably accurate".⁽¹⁴⁾ For the period 1941-1945, however,

(13) A different method would have been to deflate the Value Added directly with Wages and Salaries Indices. The difficulty here is, however, that these indices would have had to be estimated. Note, however, that the data for Value Added in constant dollars presented in Table 14 is achieved by treating Value Added as a "production" rather than "earnings" series; i.e. the current dollar output is divided by the Wholesale Price Index.

(14) Review of Foreign Trade, First Half Year, 1954, DBS, Ottawa, 1954, p. 24. The quotation does not, however, take into consideration the change in base year from 1948 to 1949. By "subdivisions" it is meant the eight groupings as per the trade statistics classification.

their validity in the usual sense is dubious. The composition in Canada's trade was sharply different from its peace time pattern in these years ... the meaning which therefore be attached to the price indexes for the war years is that they reflect movements in prices of commodities important in Canada's peacetime trade, not that they reflect the course of prices actually used in valuing all the commodities entering in Canada's trade. (15)

Moreover, where a commodity (for example, wheat) had different grades and was sold to a number of countries at non-uniform prices, then a change in the quality of the commodity or the country of destination could show up as a decline or an increase in the price index. This would naturally affect the volume series. Some of these changes are however accounted for by the Dominion Bureau of Statistics, but it is impossible to eliminate all spurious changes in price and volume. (16)

For exports by Degree of Manufacture, the problem is rather acute because there is no official price index that can be employed. The data used in this thesis was estimated by using an indirect method. That is, a price index for Raw Materials was calculated using the two broad groups of Agriculture and Other Primary Products and Non-Ferrous Metals and Their Products, and then the difference between

(15) Ibid., p. 24.

(16) See for example, R.V. Anderson, The Future of Canada's Export Trade, Queen's Printer, Ottawa, 1957, p. 4.

the index of Total Domestic Exports and the weighted Raw Material Exports was taken as the index for the Manufactured Goods Exported.

Different types of errors can be made by estimating a series in this fashion. In this particular instance, however, it does not appear that the use of this index has significantly altered any of the valuable information contained in the data.(17)

(17) In fact, any discrepancy in the series would have most probably become apparent when the current and constant dollars results were compared.

CHAPTER III

THEORY AND MODELS

In the previous chapter the difficulties involved in choosing the quantities to be used in the empirical analysis of this thesis were examined. It is the purpose of this chapter to summarize some of the work which has been performed in the field as well as the setting up of the models to be used in this thesis.

The relationship between exports and income at the national level has been analyzed by several economists in the past few years. Among them, G. Jackson in a study prepared for post-war planners suggested that "there is a definite, but complex relationship between National Income Received in a given year and the total of Exports in the preceding year".⁽¹⁾ E. Munzer, along the same lines, stressed this lagged functional behaviour of income, using more sophisticated statistical techniques.⁽²⁾ Tse-Chun Chang in a later article, while criticizing Munzer for having attempted to explain changes

(1) G. Jackson, Exports and the National Income of Canada, Toronto, 1945, p. 1.

(2) E. Munzer, "Exports and National Income of Canada", Canadian Journal of Economics and Political Science, February, 1945, pp. 35-47.

in income entirely by changes in exports, put forward an equation in three variables. Here income is an unlagged linear function of exports and investments.⁽³⁾

H.E. English finally, examined the above-mentioned relationships and extended his analysis by calculating coefficients of correlation between exports of goods and service and current business investment; commodity exports and gross domestic investment, etc., for the years 1926-1950 (omitting 1942-1945)⁽⁴⁾. Table 2, p. 55 summarizes some of the results obtained.

A) First Model

The approach used by the above-mentioned authors represents an attempt to arrive at a first approximation of the quantities studied. Therefore, of necessity, it involves an oversimplification of the analytical procedure. The proper working of a complete economic system should in fact be explained in terms of a set of equations behaving in a linear or non-linear fashion. In other words, income should not be explained only in terms of exports and

(3) Tse-Chun Chang, "A Note of Exports and National Income in Canada", Canadian Journal of Economics and Political Science, 1947, pp. 276-278.

(4) H.E. English, "The Role of International Trade in Canadian Economic Development Since the 1920's", unpublished Ph.D. Thesis, (University of California, Berkeley, 1957) quoted in R.E. Caves and R.H. Holton, The Canadian Economy, Harvard University Press, Cambridge, Mass., 1961, pp. 82-83.

Table 2

EXPORTS AND INVESTMENT MULTIPLIERS AND COEFFICIENTS OF CORRELATIONS

Author	Years Analyzed	Exports - National Income		Lagged Exports - National Income		Investment - National Income	
		Multiplier	Correlation Coefficient	Multiplier	Correlation Coefficient	Multiplier	Correlation Coefficient
G. Jackson	1923-1939	-	-	3.80	.923	-	-
E. Munzer	1923-1938	-	-	1.667	.987	-	-
T. Chang	1926-1938	1.452	.956 ^(a)	-	-	1.438	.956 ^(a)
		Exports - Investment		Lagged Exports - Investment		Exports of Goods and Services - Business Investment	
Coefficients of Correlation							
H. English	1926-1950 (excluding years 1942-1945)	0.91		0.95		0.69 ^(b)	
Sources: G. Jackson, <u>op. cit.</u> , p. 1; E. Munzel, <u>op. cit.</u> , pp. 36-38; T. Chang, <u>op. cit.</u> , p. 278; H. English, "The Role of International Trade in Canadian Economic Development Since the 1920's" quoted in R. Caves and R. Holton, <u>The Canadian Economy</u> , pp. 82-83.							
(a) This is a multiple correlation coefficient for National Income, Exports and Investment.							
(b) The period covered was 1926-1956 (excluding war years).							

investment. There is an array of other variables which affect the pattern of income growth.

This simplified procedure of income determination has however, been accepted by many economists as a way of examining long run behavioural trends as well as degrees of correlation between the variables.⁽⁵⁾ Furthermore, the linear equation $GNP = f(X,I)$; that is, Gross National Product function of exports and investment, might be thought of in terms of the structural reduced form

(5) See, for example: M. Friedman and D. Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897-1958" in Stabilization Policies, Commission on Money and Credit, Prentice-Hall, 1963. Friedman and Meiselman in this article attempt to examine the relationships between: income and the stock of money as suggested by the quantity-theory of money; and income and autonomous expenditures as suggested by the Keynesian income-expenditure theory. They define money supplied as currency in public circulation plus adjusted demand deposit plus time deposits in commercial banks. They define autonomous expenditures as net private domestic investment plus government deficits on income and product account plus net foreign balance. The analysis is based on simple regression analysis. Their conclusion is that income velocity of circulation of money is consistently and decidedly stabler than the investment multiplier except only during the early years of the Great Depression, after 1929. In this thesis, however, only part of the Keynesian aspect of the problem will be examined. The monetary aspect will not be analyzed.

of a set of equations.(6)

It is in fact for these reasons and others to be discussed below, that this procedure of multiple correlation analysis between output as the dependent variable, and exports and investment as the independent variables, has been accepted for the first model of this thesis.

Similar considerations could be made for the adoption of this type of analysis for the manufacturing sector (i.e. GDP of manufactures as a function of manufactured goods exported and investment in manufacturing industries). In this latter case, however, the weight exerted by variables such as the changing domestic markets, the cost of machinery imported, the price of competitive goods produced abroad, etc., on output of manufactures, is

(6) For example: If C is consumption, I is investment, M is imports, G is government expenditures, and X is exports, then we might assume the following behavioural relationships:

i) $C = f(Y)$, say, $= a_0 + a_1 Y$

ii) $M = g(Y)$, $= b_0 + b_1 Y$

iii) $I = I_0$ exogeneous

iv) $X = X_0$ exogeneous

v) $G = G_0$ assumed here to be insignificant. Substituting into the identity equation vi) $Y = C + I + G + X - M$ we have

vii) $Y(1 - a_1 + b_1) = (a_0 + b_0) + X + I$ or

$$Y = \frac{a_0 + b_0}{1 - a_1 + b_1} + \frac{1}{1 - a_1 + b_1} X + \frac{1}{1 - a_1 + b_1} I.$$

The export multiplier which equals the investment multiplier is $1/(1 - a_1 + b_1)$.

considerable. But again, it should be pointed out that the purpose of this simpler model is to examine the production of manufacturing industries vis-à-vis exports of manufactured goods; that is to observe the degree of association between these two variables (and investment also), rather than to measure the impact of the change in one quantity due to the change of the other quantity(ies).⁽⁷⁾

There are several other ways in which the model described above might be useful. These can be summarized as follows: a) by assessing the relative importance of the correlation coefficients for possible cause-effect patterns. That is, under the assumption that a high coefficient of correlation is a necessary but not sufficient condition for causal behaviour, the value of the correlation might point out the existence of a functional relationship. For example, a high correlation between exports and GNP, but no correlation between exports and

(7) It will be the purpose of the latter models to measure these changes in quantities. Note that symbolically the first model could simply be expressed as:

$$\text{GNP} = a_0 + a_1E + a_2I$$
 (where GNP is gross national product, E is exports of goods and services, I is business gross fixed capital formation),

$$Q = k_0 + k_1E_Q + k_2I_Q$$
 (where Q is gross domestic product originating in manufacturing industries, E_Q is exports of manufactured goods and I_Q is investment of manufactures).

investment might suggest a direct impact of exports on GNP without the intermediate step of change in investment. Moreover, the introduction of lags and first differences in these three variable analyses can define the time limits within which the process takes place;

b) by comparing the values of the correlation and regression line coefficients between: i) short-run and long-run periods; (8) ii) manufacturing sector and aggregate economy;

c) by examining "quantitatively" the values of the multipliers obtained by this method with those calculated by using other models. That is, to observe whether this simpler model differs from the other models in this thesis, say only in inflating or deflating the values of the multipliers, but leaving their relative movements proportional. In other words, to see whether changes in multiplier values are reflected in this model just as well as in other models, even though the absolute values might not be the "correct" ones. (9)

(8) In this thesis, the only inter-temporal comparison is between the regression line coefficients (or multipliers) for the period 1926-1938 (as calculated by Chang) and the period 1920-1965.

(9) It is realized that the "correct" value of any multiplier, is only a hypothetical one. Here it is assumed that the "ideal" value of multiplier reaches a limit as the model becomes more sophisticated. See for example: S. May, "Dynamic Multipliers and Their Use for Fiscal Decision-Making", in Conferences on Stabilization Policies, Queen's Printer, Ottawa, 1966.

B) Second and Third Models

The main purpose of the previous model was to determine the possible direction of causation between the variables examined. The two models presented in this section attempt to measure the actual values of the export multipliers. Before introducing the models, however, the meaning of impact and equilibrium multipliers will be briefly defined.

Assume a dynamic system of the form

$$1) BY_t^i + CY_{t-1}^i + DZ_t^i = 0$$

$$\text{or } 2) Y = -B^{-1}CY_{t-1}^i - B^{-1}DZ_t^i$$

where B, C, and D are matrices of the parameters.

Y_t^i and Y_{t-1}^i are vectors of endogeneous variables unlagged and lagged one period, respectively.

Z_t^i is a vector of the exogeneous variables. Then the impact multiplier is defined as

3) $\Delta Y^i / \Delta Z^i = -B^{-1}D$. That is, a change in the endogeneous variables due to a change on the exogeneous variable(s) occurring within time "t".

The equilibrium multiplier, on the other hand, is defined as change in the endogeneous variables due to a change in the exogeneous variable(s): the measurement of the change being taken between two stationary equilibria. That is, equilibrium multipliers show the changes between

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two equilibria, assuming the system starts at a position of stationary equilibrium and after the disturbance settles at a new stationary equilibrium. In mathematical terms: rewrite 2) as

$$4) \quad Y'_t = F_1 Y'_{t-1} + F_0 Z'_t \quad \text{then for stationary equilibrium}$$

$$\bar{Y}'_t = Y'_t = Y'_{t-1} \quad \text{and}$$

$$5) \quad \bar{Y}'_t = F_1 \bar{Y}'_t + F_0 Z'_t \quad \text{or}$$

$$6) \quad \bar{Y}'_t = (I - F_1)^{-1} F_0 Z'_t$$

Now, assuming the Z to occur at time " t " and the new stationary equilibrium at time " $t + n$ ",

$$7) \quad \bar{Y}'_{t+n} = \bar{Y}'_t + \Delta \bar{Y}'_{t,n} = (I - F_1)^{-1} F_0 (Z'_t + \Delta Z'_t)'$$

$$\text{Subtracting 6) from 7) } \Delta \bar{Y}'_{t,n} = (I - F_1)^{-1} F_0 \Delta Z'_t$$

and $\partial \bar{Y}'_{t,n} / \partial Z'_t = (I - F_1)^{-1} F_0$ which is the equilibrium multiplier.

Impact and equilibrium export multipliers, thus, serve two definite purposes. While the former measures the effects of a change of exports on income, say, accrued only within the period of the change itself; the latter gives the summation (which might extend over an infinite number of years) of all the effects on income due to this particular initial change in exports.

In formulating economic policies the knowledge of these multipliers (i.e. not only export multipliers, but

also fiscal, monetary, etc.) is naturally of great importance. In fact, depending upon the status of the economy, alternative policies will be required. The choice and implementation of these policies will be based on the estimated "magnitude" as well as on "speed of reaction" of the different multipliers.⁽¹⁰⁾

While a way of estimating these multipliers for the period 1920-1965 is suggested in the models presented on the following pages, there is a need to differentiate at this point between the various concepts associated with "speed of reaction". For monetary and fiscal policies the idea of "lags" has been used in the literature.⁽¹¹⁾ In this thesis, however, the concept of "gestation period" has been introduced. The latter is defined as the time elapsing between a change in the exogenous variable and the consequent completed effect on the economic system. There is at least one important reason for adopting this new

(10) For example, if the economy requires an immediate boost, then a policy which produces a large impact multiplier will be chosen. Naturally, there are several other factors, political, social, etc., which must be taken into consideration before choosing a policy.

(11) Inside and outside lags are defined respectively as: the lag between the appearance of a need for a change in policy in the economy and the corresponding change in policies; and the lag between a change in policy and the appearance of a response in the economy (see for example H.G. Johnson, The Canadian Quandary, McGraw-Hill, Toronto, 1963).

concept. Lags refer mainly to a time period; gestation period on the other hand has inbedded in it both a time and a quantity dimension. For example: in the snowball effect, as time changes also the dimensions of the ball are being altered.(12)

A method of finding an approximate length of the gestation period is by the straightforward least squares estimation; that is, by having one of the variables on the right hand side of the equation repeatedly lagged, (i.e. one value for each time period that has to be analyzed). For example, assume that for two variables X and Y and a constant A, there exists a relationship:

$$Y_t = A + X_t + Y_{t-1} + Y_{t-2} + \dots + Y_{t-n}.$$

Then, this "recursive" equation implies that Y_t is a weighted sum of the current and past values of X_t with a particular pattern of weights. This is what is meant by saying that the above equation determines a "distributed lag" relation between Y and X. In the case of the above equation the sequence of weights can be calculated by successive substitutions.(13)

(12) A second and third reasons would be that the outside lag has been mainly associated with time periods in policy change analysis (changes in "instrument" variables such as fiscal and monetary policies). Gestation period on the other hand refers to the effects occurring from changes in a "target" variable (exports in this case). Also, the outside lag is concerned with the time of "appearance" of an effect of a policy, gestation period is concerned with the "completed" effect of this policy.

(13) This type of analysis is used by: A. Ando, E. Cary Brown, R.M. Solow and J. Kareken, "Lags in Fiscal and Monetary Policy", in Stabilization Policies, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1963, pp. 26-30.

A second method and the one used in this thesis because simpler to work with, consists of correlating lagged and unlagged changes (i.e. yearly first differences) in exports with changes in income. Here a "no correlation" between these two variables is assumed to mean that the gestation period is still progressing. A relatively high correlation, on the other hand, would show the ending of the gestation period within that particular year.

Second Model

I. AGGREGATE CANADIAN ECONOMY

If C represents consumption

M represents imports of goods and services

GNP represents gross national product

I represents investment

G represents government expenditures

E represents exports of goods and services

t represents a given period of time,

then

Assume 1) $C = a_1 + a_2C_{t-1} + a_3GNP$

and assume 2) $M = b_1 + b_2GNP$

given 3) $GNP = C + I + G + E - M$ (IDENTITY)

finally 4) $GNP = f_1 + f_2C_{t-1} + f_3Z^*$

where: $f_1 = (a_1 - b_1)/(1 - a_3 + b_2)$,

$f_2 = a_2/(1 - a_3 + b_2)$

$f_3 = 1/(1 - a_3 + b_2)$

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and $Z^* = I + G + E$.

The exports impact multiplier is here: $\frac{1}{1 - a_3 + b_2}$

II. CANADIAN MANUFACTURING SECTOR

If C, I, G, and M all represent the same variables as in the previous model, and GDP represents gross domestic product

Q represents manufacturing output

\emptyset represents non-manufacturing output

E_Q represents manufactured goods exports

E_{\emptyset} represents non-manufactured goods and services exported

T^* represents indirect taxes less subsidies

Y^* represents income received from non-residents minus income paid to non-residents.

then if

Assume 1) $GDP = \sum_{i=1}^n GDP_i = Q + \emptyset$

Given 2) $GDP = C + G + I + E_Q + E_{\emptyset} - M - (T^* + Y^*)$
(IDENTITY)

and assume 3) $Q = f(GDP, E_Q)$

and assume 3*) $\emptyset = g(GDP, E_{\emptyset})$

or 4) $Q = a_1 + a_2 GDP + a_3 E_{\emptyset}$

or 4*) $\emptyset = b_1 + b_2 GDP + b_3 E_{\emptyset}$

assume also 5) $C = c_1 + c_2 C_{t-1} + c_3 GDP$

then 6)
$$Q = a_1 + a_2 \left\{ (1/1 - c_3) [G + I + E_Q + E_\emptyset - M - (T^* + Y^*) + c_1 + c_2 C_{t-1}] \right\} + a_3 E_Q + \frac{a_2 E_Q}{1-c_3}$$

and finally 7)
$$Q = f_1 + f_2 Z^{**} + f_3 C_{t-1} + f_4 E_Q$$

where: $f_1 = a_1 + a_2 c_1 / (1 - c_3), \quad f_2 = a_2 / (1 - c_3)$

$f_3 = a_2 c_2 / (1 - c_3), \quad f_4 = a_3 + a_2 / (1 - c_3)$

and $Z^{**} = GDP - C - E_Q$

The manufacturing exports impact multiplier is

here:
$$a_3 + \frac{a_2}{(1 - c_3)}$$

Third Model

EQUILIBRIUM MULTIPLIER FOR THE AGGREGATE CANADIAN ECONOMY

If C, GNP, M, Z, and t all represent the same variables as in the first model, then:

Assume
$$\Delta C_t = a_2 \Delta GNP_{t-1} + a_3 \Delta GNP$$

and assume
$$\Delta M_t = b_2 \Delta GNP$$

also
$$\Delta GNP = \Delta C_t + \Delta Z_t - \Delta M \text{ (IDENTITY)}$$

Substituting
$$\Delta GNP_t = \frac{1}{1 - a_3 + b_2} \left\{ a_2 \Delta GNP_{t-1} + \Delta Z_t \right\}$$

or
$$\begin{aligned} \Delta GNP_t &= \gamma_1 \Delta GNP_{t-1} + \gamma_2 \Delta Z_t \\ &= \gamma_1 (\gamma_1 \Delta GNP_{t-2} + \gamma_2 \Delta Z_{t-1}) + \gamma_2 \Delta Z_t \\ &= \gamma_1 \left[\gamma_1 (\gamma_1 \Delta GNP_{t-3} + \gamma_2 \Delta Z_{t-2}) + \gamma_2 \Delta Z_{t-1} \right] \\ &\quad + \gamma_2 \Delta Z_t . \end{aligned}$$

$$\Delta GNP_t = \gamma_1^3 \Delta GNP_{t-3} + \gamma_1^2 \gamma_2 \Delta Z_{t-2} + \gamma_1 \gamma_2 \Delta Z_{t-1} + \gamma_2 \Delta Z_t$$

.....

$$\Delta GNP_t = \gamma_1^n \Delta GNP_{t-n} + \gamma_1^{n-1} \gamma_2 \Delta Z_{t-n+1} + \gamma_1^{n-2} \gamma_2 \Delta Z_{t-n+2} + \gamma_2 \Delta Z_t$$

The change in GNP in year one due to a change in exports in year one will be:

$$\Delta GNP_1 = \gamma_2 \Delta Z_1$$

In year two the change in GNP due to the change in exports in year one will be:

$$\Delta GNP_2 = \gamma_1 \Delta GNP_1$$

Substituting $\Delta GNP_2 = \gamma_1 \gamma_2 \Delta Z_1$

In year three the change in GNP due to the change in exports in year one will be:

$$\Delta GNP_3 = \gamma_1 \Delta GNP_2$$

Substituting $\Delta GNP_3 = \gamma_1^2 \gamma_2 \Delta Z_1$

In year four the change in GNP due to the change in exports in year one will be:

$$\Delta GNP_4 = \gamma_1 \Delta GNP_3$$

Substituting $\Delta GNP_4 = \gamma_1^3 \gamma_2 \Delta Z_1$

.....

$$\Delta GNP_n = \gamma_1^{n-1} \gamma_2 \Delta Z_1$$

Summing up all the GNP changes due to the increase (or decrease) in exports:

$$\begin{aligned}\sum_{i=1}^n \Delta \text{GNP}_i &= \gamma_2 (1 + \gamma_1 + \dots + \gamma_1^{n-1}) \Delta Z_1 \\ &= \gamma_2 \frac{1 - \gamma_1^n}{1 - \gamma_1} \Delta Z_1\end{aligned}$$

Now since $\gamma < 1$

$$\sum_{i=1}^{\infty} \text{GNP}_i = \frac{\gamma_2}{1 - \gamma_1} \Delta Z_1$$

$\frac{\gamma_2}{1 - \gamma_1}$ is the equilibrium export multiplier.

Two cautionary comments should however be made with respect to these models. First of all, it is recognized that the above models do over-simplify reality. Additional behavioural equations should have been included in the analysis rather than treat some of the variables as exogenous. This applies principally to imports in the "impact export multiplier" for the manufacturing sector. Furthermore, other variables such as prices, exchange rate, etc. should have been introduced into the models. Secondly some apparent inconsistencies such as the substitution of lagged income for lagged consumption as an independent variable in the consumption function of one of the models, had arisen because of the necessity to simplify some of the algebra.

CHAPTER IV

QUANTITATIVE FINDINGS AND THEIR SIGNIFICANCE

The previous chapter presented some theoretical discussion and introduced the models to be used in this dissertation. This chapter shows the results obtained, and comments on the relative importance of the values.

The data are grouped under two headings: the first deals with those findings derived by using the simple linear relationship of income as a function of investment and exports only; the second is concerned with the values of the multipliers using the two latter models as developed in Chapter III, pp. 60-68. These two sets of results relating to "correlation and regression line coefficients - national and manufacturing sectors" and "impact multipliers for the national economy and the manufacturing sector" and "equilibrium multiplier for the national economy" respectively, are labelled as: Set A Results and Set B Results.

Set A Resultsa) Correlation Coefficients - National Level.

Table 3 below shows the different values of the coefficients of correlation for three pairs of variables

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(i.e. gross national product and exports of goods and services, gross national product and business gross fixed capital formation, and exports of goods and services and business gross fixed capital formation), for the period 1920-1965, including the war years - constant dollars (1949 = 100). The subscript under the variables in the column "cases", indicates the length of the lag or lead, in years.

Table 3

Cases	GNP and E	GNP and I	E and I
1 GNP _t , E _{t+1} , I _{t+1}	.907	.948	.777
2 GNP _t , E _t , I _t	.918	.949	.779
3 GNP _t , E _{t-1} , I _{t-1}	.906	.937	.753
4 GNP _t , E _{t-2} , I _{t-2}	.837	.922	.724
5 GNP _t , E _{t-1} , I _{t-2}	.902	.922	.733

(see text for explanations and Table 15 for data)

Table 4, on the other hand, has the same three pairs of variables, for the same period of time, but it excludes the war years. Moreover, the values are in constant as well as in current dollars. Also, the coefficients of correlation for the first differences are shown. The lags, however, are limited to only one year.

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Table 4

Cases		GNP and E	GNP and I	E and I
1 GNP_t, E_t, I_t	Const \$.975	.974	.930
	Current \$.994	.992	.985
2 GNP_t, E_{t-1}, I_{t-1}	Const \$	.981	.959	.926
	Current \$	.994	.984	.982
3 $\Delta GNP_t, \Delta E_t, \Delta I_t$	Const \$	.202	.768	.107
	Current \$	.879	.838	.721
4 $\Delta GNP_t, \Delta E_{t-1}, \Delta I_{t-1}$	Const \$	.658	.189	.104
	Current \$	.725	.455	.720

(see text for explanations and Table 15 for data)

b) Correlation Coefficients - Manufacturing Sector.

Table 5 portrays the sets of coefficients of correlation for three pairs of variables (gross domestic product of manufacturing and exports of partially and fully manufactured goods, gross domestic product of manufacturing and business gross fixed capital formation of manufacturing, and exports of partially and fully manufactured goods and business gross fixed capital formation of manufacturing), for the period 1920-1965, excluding the war years, in constant (1949 = 100) and current dollars. Also the correlation coefficients for the first differences of those same variables are shown.

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Table 5

Cases		Q and E_Q	Q and I_Q	E_Q and I_Q
1 Q_t, E_{Q_t}, I_{Q_t}	Const \$.968	.945	.928
	Current \$.991	.978	.978
2 $Q_t, E_{Q_{t-1}}, I_{Q_{t-1}}$	Const \$	.970	.928	.915
	Current \$	.993	.973	.975
3 $\Delta Q_t, \Delta E_{Q_t}, \Delta I_{Q_t}$	Const \$	.461	.689	.535
	Current \$	.777	.784	.641
4 $\Delta Q_t, \Delta E_{Q_{t-1}}, \Delta I_{Q_{t-1}}$	Const \$	.438	.207	.528
	Current \$	.614	.262	.629

(see text for explanations and Table 18 for data).

Table 6 shows the correlation coefficients between different variables. The data are in current dollars and cover the period 1920-1965, war years included. In this Table the value added in manufacturing rather than the GDP of manufacturing is used.

Assessment of the Results in Tables 3 to 6

An overall assessment of the results contained in the above Tables and supplementary Graphs presented in Appendix I suggests that, in general, the correlation between exports and GNP is higher when exports are lagged one year. For the manufacturing sector, on the other hand, the difference between the results calculated with

Table 6

Variables	Investment in Manufacturing	Exports of Raw Materials	Exports of Partially Manufactured Goods	Exports of Fully Manufactured Goods	Exports of of Manufactured Goods ^(a)	Total Exports of Goods
1 Value Added by Manufacturing	.974	.968	.992	.913	.973	.984
2 Investment in Manufacturing	-	.952	.977	.872	.943	.958

(a) This includes Exports of Partially plus Fully Manufactured Goods.

(see text for explanations and Tables 18 and 20 for data).

lagged and those obtained with unlagged values does not seem especially significant.

Examining more closely the results applying to the aggregate economy, the third and fourth lines of Table 4 reveal a certain behavioural pattern in the "export-output" relationship.⁽¹⁾ According to the values shown in the third line, in fact, there appears to be no correlation between GNP and unlagged values of exports of goods and services valued in constant dollars. The fourth line of the same table, on the other hand, suggests that the correlation (i.e. between GNP and exports) exists if exports are lagged one year. Table 3 shows slightly higher values for correlations of unlagged variables, but these latter quantities should be examined with caution, since the data include the war years.

On an "a-priori" reasoning, based upon the increase in the volume of foreign trade and the significant improvement of transportation, communication and payment systems, this author would have expected a considerable shortening in the gap between exports and the impact upon national income. In other words, as the period under observation increased (i.e. as more post-second World War years were included in the data) the lag between cause (exports) and effect (income) should have decreased considerably.

(1) Naturally, under the assumptions presented in pages 58-59 of Chapter III.

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The fact that no significant change has occurred in the lags could in part be explained by the growing importance of agricultural exports in this post-war period. That is, to the extent that at least one year is necessary between the sales abroad of grains and new increased output,⁽²⁾ the lag between exports and new income does not vary considerably over the years.

As mentioned above, the findings for the manufacturing sector show that the results obtained by correlating lagged variables (i.e. investment in manufacturing and exports of manufactured goods) with output of manufactures do not differ greatly from those calculated using unlagged variables. On the other hand, the values calculated using first differences suggest that a "no-lag" assumption might be more appropriate in correlating these variables.

The second set of observations is concerned with the "exports-investment" relationship. Here, Dr. English has postulated that the correlation between commodities exports and lagged investment is higher than that of exports of goods and services, and investment exclusive of residential construction.⁽³⁾ Even though a direct

(2) This happens because the time needed between output and new seeding and harvesting is about a year. Note this observation applies also to animal products.

(3) Quoted in R.E. Caves and R.H. Holton, The Canadian Economy, pp. 82-83.

investigation of this hypothesis is not possible because of the difference in the variables used in this thesis, the data available suggest similar conclusions.⁽⁴⁾ The first difference correlations provide additional support to this point of view since no correlation appears to exist between exports of goods and services and business gross capital formation, for the economy as a whole.⁽⁵⁾

The introduction of lags into this particular correlation analysis does not seem to alter significantly the results. In this latter case, however, the coefficients of correlation for both the manufacturing sector and the aggregate economy are slightly lower than the former values, i.e. when the lags were absent.

In connection with the impact that exports have on investments, one of the results in Table 6 is of particular significance. The second line of this table shows in fact that the highest correlation occurs between investment in manufacturing and exports of partially manufactured goods. If this observation is placed within the context

(4) The values in the last column of Table 3 are, in fact, rather low if compared with the coefficients of correlation shown in the other column. On the other hand, the value in the last column, second line of Table 6 is approximately .96.

(5) See Table 4, lines three and four, in constant dollars, last column. Also, the minimum values of the correlation coefficients for a level of significance of .01 and 40 observations are based on: S.B. Richmond, Statistical Analysis, The Ronald Press Co., New York, 1964, p. 582, Appendix G.

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of investment and economic growth as suggested in the Harrod-Domar model, then the importance of exports of partially manufactured goods becomes apparent.⁽⁶⁾ In fact, to the extent that new investment induces additional income through the multiplier effect, exports of partially manufactured goods appear to have played a significant role in this country's economic development.⁽⁷⁾

The third group of correlation analyses examines the "investment-income" relationship. The findings suggest that the investment multiplier acts in a relatively "fast" manner (i.e. within a year). The "first difference" analysis of Tables 4 and 5 (GNP and I and Q and I_Q columns, respectively) shows in fact, very low coefficients of correlation between these two variables, when output is lagged one year. In terms of the definition expressed in the third Chapter, it can be suggested that investment has a relatively short gestation period.

The observations outlined in the latter three paragraphs seem to point out a possible generalization on the direction of causation between exports and income. That is, if two basic assumptions are made, different types of causal relationships (i.e. for the economy as a

(6) See Chapter I, page 38.

(7) Naturally, also the amounts of partially manufactured goods exported have been considerably large.

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whole and for the manufacturing sector, respectively) are likely to occur.

Thus, assuming that: a) a high (or relatively high) coefficient of correlation is a necessary though not sufficient condition for causal relationship to exist, and b) exporting firms are producing near or at full capacity,⁽⁸⁾ then, the following behavioural patterns are suggested. The first one, for the national economy postulates that the multiplier effect which creates additional income through expenditures at home of foreign earnings, acts with a lag of one year. That is, the increase in investment, and therefore, expansion of the GNP occur only after the money earned abroad is spent on the domestic market. In other words, exports of goods and services increase income which induce additional investment (accelerator) which further increases income (multiplier). This process appears to be at least one year long. The second type of causal relationship as experienced by the manufacturing sector, has exports creating additional output through the direct effect on business expectations. That is, as sales abroad grow, businessmen expect further increase in total demand (domestic and

(8) See also the next footnote.

foreign) and accordingly expand their productive capacity.(9)

Table 6 goes a step further by showing which of the commodities exported (i.e. raw materials, partially manufactured goods, and fully manufactured goods) is more closely correlated to value added (and investment) in manufacturing. To the extent that these data include the war years and they are expressed in current dollars, the coefficients are somewhat biased. However, since the purpose of this Table is to compare values within the Table itself, it could be assumed that the errors affect each coefficient generally in the same manner. Accepting the validity of this assumption, the data support the conclusion that there is a higher correlation between exports of partially manufactured goods and value added in manufacturing than is the case either for exports of raw materials (small employment and income, but large volume) or for exports of fully manufactured goods (high employment and income content, but small volume).

A possible conclusion emerging from the findings discussed in the above paragraph is that the impact of exports on income earned is relatively large in those industries where the capital-output ratio is comparatively

(9) It is assumed here that an increase in domestic demand might be supplied by diverting a quantity of goods for exports to the home market. But an increase in demand for exports, generally, increases the firm's output.

high.⁽¹⁰⁾ This conclusion seems to strengthen further the hypothesis previously expressed, namely that exports of manufactured goods act directly on investment in manufacturing industries to produce additional income. It is because of this process that those industries producing goods with a high capital-output ratio (i.e. partially manufactured goods) also give rise to a large value of income.

A second conclusion based on the results shown above is a variation of what might be called a Friedman-Mieselman thesis.⁽¹¹⁾ In comparing statistically and graphically the "investment-income" and the "export-income" relationships at the national aggregate level, it appears as if exports have affected income in a more effective, stable, as well as predictable way than investment.⁽¹²⁾ This further supports the proposition that in the Canadian economy exports might be considered as

(10) The relatively recent publication by D. Creamer, Capital Expansion and Capacity in Postwar Manufacturing, The Conference Board, New York, 1961, suggests (in tabular form) that the capital-output ratio for partially manufactured goods is rather large. In fact, to the extent that these U.S. values might be comparable to Canadian values, the capital-output ratio for "Lumber and Products" is the highest for manufacturing industries. (See, D. Creamer, op. cit., Table 3, p. 21). The capital-output ratios for non-ferrous products, and paper and allied products are also considerably high.

(11) See pp. 55-56, Chapter III.

(12) As pointed out, in Chapter III, the money supply variable has not been analyzed in this thesis.

perhaps the basic income determining factors.

There are two additional observations which can be usefully made as applications to the data presented in this thesis; a) the values in current dollars are always higher than those in constant dollars as they reflect the associated trend of prices. This is especially true in the "first difference" rows. b) Certain behavioural patterns which appear to be rather strong when the absolute values are correlated, are practically non-existent when first differences are correlated (for example, the correlation between exports and investments of Table 4).⁽¹³⁾

c) Regression Line Coefficients - National Level.

Table 7 gives the values of the regression line coefficients as well as the coefficient of multiple determination, the standard error, and the Durbin-Watson statistic.⁽¹⁴⁾ The data used in obtaining these results are the same as for Table 4. It should be noted that in this Table as well as in the next Table (i.e. Table 8), the values of the export multipliers and investment multipliers are respectively under the "first coefficient" column and "second coefficient" column.

(13) High correlation in these absolute values (i.e. not the first differences) may be due to similar growing trend patterns.

(14) For a more detailed account of the meaning of statistical terminology, see Appendix III.

Table 7

Equation	R ²	S	Constant	First coefficient	Second coefficient	D-W
GNP _t : E _t + I _t	.951	1915.6	-1914.5	4.39 T(27.4)		
Constant \$	.984	1091.8	- 362.7	2.29 T(9.20)	2.61 T(9.06)	1.175
GNP _t : E _{t-1} + I _{t-1}	.963	1659.6	-2540.5	4.75 T(31.4)		
Constant \$	.981	1220.8	-1246.8	3.17 T(10.7)	1.90 T(5.76)	1.212
ΔGNP _t : ΔE _t + ΔI _t	.590	556.0	426.7		2.18 T(7.39)	
Constant \$	.604	553.3	392.7	0.21 T(1.17)	2.14 T(7.26)	1.566
ΔGNP _t : ΔE _{t-1} + ΔI _{t-1}	.433	643.5	512.2	1.13 T(5.31)		
Constant \$	.447	643.8	478.5	1.10 T(5.18)	0.34 T(0.98)	1.509

Table 7 (continued)

Equation	R ²	S	Constant	First coefficient	Second coefficient	D-W
GNP: $E_t + I_t$	.988	1651.0	-1809.0	4.84 T(55.8)		
Current \$	.993	1224.3	-304.4	2.72 T(7.29)	2.16 T(5.74)	0.482
GNP: $E_{t-1} + I_{t-1}$	.988	1624.4	-2085.2	5.24 T(56.3)		
Current \$	.990	1533.3	-1306.2	4.14 T(8.84)	1.12 T(2.38)	1.021
Δ GNP _t : $\Delta E_t + \Delta I_t$	.772	724.0	406.5	3.09 T(11.4)		
Current \$	.859	576.4	343.0	2.01 T(6.42)	1.37 T(4.79)	1.381
Δ GNP _t : $\Delta E_{t-1} + \Delta I_{t-1}$	.525	1026.9	635.8	2.51 T(6.40)		
Current \$	.535	1031.0	653.9	2.85 T(5.03)	-0.46 T(-0.84)	1.549

(see text for explanations and Table 15 for data).

d) Regression Line Coefficients - Manufacturing Sector.

Table 8, below, shows the values of: regression line coefficients, coefficient of multiple determination, standard error, and Durbin-Watson statistic. The quantitative findings obtained here were calculated from the same data as for Table 5.

Tables 7 and 8 stem in effect from an extension of Chang's analysis which covered the period 1926-1938. Indeed, the model for this section is, as suggested in Chapter III, structurally the same as Chang's model, but slightly different data and a longer period of observations were used.⁽¹⁵⁾ Under the assumption, however, that the difference in data does not significantly affect the regression coefficients, the findings as presented in Tables 7 and 8 represent a useful means of comparing the long-run aggregate-economy values with the long-run manufacturing sector values.

(15) The main difference in the data is that the model presented in this thesis uses largely "gross" values (e.g. GNP, business gross capital formation, gross domestic product of manufacturing), while Chang uses "net" values (e.g. Money national income, net home investment). Gross values were used because they represent a more inclusive measurement of income, and the independent variables

Table 8

Equation	R ²	S	Constant	First coefficient	Second coefficient	D-W
$Q_t: E_{Q_t} + I_{Q_t}$	.937	623.1	-1199.6	2.52 T(24.1)		
Constant \$	.953	549.3	- 879.8	1.72 T(6.94)	2.50 T(3.49)	.6387
$Q_t: E_{Q_{t-1}} + I_{Q_{t-1}}$	.941	601.8	-1367.9	2.73 T(24.7)		
Constant \$	.948	575.2	-1166.1	2.21 T(8.46)	1.61 T(2.14)	.8247
$\Delta Q_t: \Delta E_{Q_t} + \Delta I_{Q_t}$	.475	198.9	163.4		1.61 T(5.86)	
Constant \$	.487	199.2	152.3	0.17 T(0.93)	1.45 T(4.45)	1.626
$\Delta Q_t: \Delta E_{Q_{t-1}} + \Delta I_{Q_{t-1}}$	.192	244.7	166.2	0.58 T(2.96)		
Constant \$	.192	247.9	166.1	0.61 T(2.58)	-0.078 T(-0.19)	1.401

Table 8 (continued)

Equation	R ²	S	Constant	First coefficient	Second coefficient	D-W
$Q_t: EQ_t + I_{Q_t}$	.981	481.4	-331.0	2.28 T(45.3)		
Current \$	.983	462.5	-193.0	1.81 T(7.85)	1.26 T(2.06)	.5584
$Q_t: EQ_{t-1} + I_{Q_{t-1}}$	.986	425.6	-390.1	2.48 T(50.9)		
Current \$	.986	423.7	-325.2	2.23 T(10.2)	0.69 T(1.16)	1.396
$\Delta Q_t: \Delta EQ_t + \Delta I_{Q_t}$	.615	228.8	172.8		1.84 T(7.78)	
Current \$	.743	189.4	123.8	0.69 T(4.30)	1.14 T(4.47)	1.233
$\Delta Q_t: \Delta EQ_{t-1} + \Delta I_{Q_{t-1}}$	.377	286.0	177.5	0.90 T(4.74)		
Current \$	.403	284.0	177.0	1.09 T(4.49)	-0.51 T(-1.24)	1.715

(see text for explanations and Table 18 for data).

investment and income, have not varied significantly. In other words, the independent variables show a similar degree of influence on the dependent variable.⁽¹⁷⁾

Second, comparing the numerical analyses of Table 2 and Tables 7 and 8, this latter set of results show additional statistical information. These supplemental values, such as the standard error, the t-value, and the Durbin-Watson ratio, help to further understand and assess the completeness of the model used. For example, the low Durbin-Watson ratio (.6387) for the manufacturing sector (second line, last column, Table 8) implies that the random variable still contains serial correlation. Only a restatement of the theory could eliminate part or all of this unexplained pattern within the random variable. Furthermore, assuming arbitrarily and rather hazardously that the Durbin-Watson ratio measures the validity of the model constructed, it appears that this simple model is more useful in the analysis of the aggregate economy than in the study of the sectoral behaviour. That is, the error in using this type of model appears to diminish as the analysis shifts from a particular sector to the whole economy.⁽¹⁸⁾

(17) See also the graphical analysis.

(18) This result on the size of error for this particular model using national aggregates and sectors had to be expected. In fact, while national income can roughly be explained in terms of, say, exports, investment and government expenditures; manufacturing income is thought as a function of a number of other variables, besides, naturally exports and investment manufacturing.

Set B Resultse) Impact Multipliers - National Level

Table 9 gives the values of the impact export multipliers (tabulated in the "second coefficient" column), the coefficient of multiple determination, the standard error and the Von Neumann ratio. The variables correlated are: gross national product (GNP), lagged consumption (C_{t-1}) and the sum of: exports of goods and services, business gross fixed capital formation, and government expenditures (Z_t^*). The data cover the period 1920-1965.

f) Impact Multipliers - Manufacturing Sector

Table 10 shows the values of the impact export multipliers (tabulated in the "third coefficient" column), the coefficient of multiple determination, the standard error, and the Von Neumann ratio. The variables used in this correlation analysis are: gross domestic product less consumption less exports of manufactured goods (Z_t^{**}), lagged consumption (C_{t-1}) and exports of manufactured goods (E_Q). The data cover the period 1920-1965.

Tables 9 and 10 show the impact export multipliers for the aggregate economy and the manufacturing sector, respectively. Analyzing first of all Table 9, several values are given as export multipliers. The value which

Table 9

Equation	R ²	S	Constant	First coefficient	Second coefficient	V-N
$GNP_t = f_1 + f_2 C_{t-1} + f_3 Z_t^*$	.959	1632.9	589.5	1.51 (0.047)		0.7307
Constant \$ (war years included)	.991	792.0	- 80.4	0.88 (0.057)	0.73 (0.061)	1.176
$GNP_t = f_1 + f_2 C_{t-1} + f_3 Z_t^*$	.989	1443.5	154.6		1.63 (0.025)	0.5350
Current \$ (war years included)	.998	598.0	-249.2	0.84 (0.058)	0.84 (0.056)	1.244
$GNP_t = f_1 + f_2 C_{t-1} + f_3 Z_t^*$	.990	850.0	167.6		1.68 (0.027)	1.040
Constant \$	.995	622.1	- 4.28	0.49 (0.083)	1.16 (0.091)	1.265
$GNP_t = f_1 + f_2 C_{t-1} + f_3 Z_t^*$	.997	844.5	533.9		1.63 (0.015)	0.8127
Current \$	.999	467.5	31.0	0.60 (0.063)	1.07 (0.060)	1.221

(see text for explanations and Tables 15 and 16 for data).

Table 10

Equation	R ²	S	Constant	First Coeff.	Second Coeff.	Third Coeff.	V-N
$Q_t = f_1 + f_2 Z^{**} + f_3 C_{t-1} + f_4 EQ_t$	.944	555.7	-479.7		0.43 (0.016)		0.6140
Constant \$	.979	343.7	-882.7		0.34 (0.015)	0.61 (0.072)	1.065
(including war years)	.986	282.9	-821.0	0.34 (0.073)	0.30 (0.014)	0.52 (0.062)	1.262
<hr/>							
$Q_t = f_1 + f_2 Z^{**} + f_3 C_{t-1} + f_4 EQ_t$	.976	518.5	-41.3		0.40 (0.009)		0.5542
Current \$	.992	307.8	-302.8		0.25 (0.017)	0.88 (0.097)	0.8150
(including war years)	.994	261.0	-62.9	0.39 (0.092)	0.18 (0.022)	0.69 (0.093)	0.5902

Table 10 (continued)

Equation	R ²	S	Constant	First Coeff.	Second Coeff.	Third Coeff.	V-N
$Q_t = f_1 + f_2 Z^{**} + f_3 C_{t-1} + f_4 EQ_t$	.969	439.4	-658.7		0.44 (0.013)		1.020
Constant \$	.981	348.3	-955.2		0.29 (0.032)	0.90 (0.18)	1.062
	.989	265.9	-918.8	0.37 (0.070)	0.23 (0.027)	0.92 (0.14)	1.354
<hr/>							
$Q_t = f_1 + f_2 Z^{**} + f_3 C_{t-1} + f_4 EQ_t$	.982	466.7	-179.3		0.40 (0.009)		0.7626
Current \$	.993	304.5	-299.6		0.21 (0.027)	1.12 (0.15)	0.8431
	.995	245.9	-46.6	0.41 (0.090)	0.12 (0.029)	0.98 (0.13)	0.4789

(see text for explanations and Tables 16 and 18 for data).

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should be taken as the closer approximation to the "real value" of the impact multiplier is 1.16. This value is in fact relatively unbiased by war years or by price changes. Moreover the magnitude of the errors appears to be smaller for this particular regression than for any other equation presented in the Table.

Examining the multiplier quantity itself, it suggests that for every dollar exported in year "t", 1.16 dollars of GNP were generated within the year "t". It should be noted that this value is an average over the 45 years and, again, it measures only the induced GNP for the same year the goods were exported. Furthermore, in this particular model, the export multiplier equals the investment multiplier and the government expenditures multiplier. (19)

Table 10 shows the impact export multipliers for the manufacturing sector. Using the same criteria of choice as for the whole economy multiplier, the value obtained here is 0.92. In other words one dollar of exported manufactured goods has induced on the average 92 cents of income originating in manufacturing, the same year. The apparent paradox of a multiplier smaller than one can be

(19) This is easily proved by partially differentiating the equation in the first column of Table 9 with respect to exports, investments and government expenditures, respectively.

clarified by the following observations. First of all, in the regression analysis, the variable Q indicates GDP of manufactures or, as suggested in Chapter II of this thesis, approximately, value added by manufactures. On the other hand, the variable E_Q represents exports of manufactured goods which includes also the value of raw materials used in the production of the goods. A more significant variable for a regression of this type might have been, say, E_{Q^*} . Where E_{Q^*} are exports of manufactured goods net of the imbedded raw materials. Similarly, value of shipments of manufacturing industries might have been a better variable to compare with E_Q . These suggested changes, however, would have made more difficult the creation of a model of the same type used here.⁽²⁰⁾

Secondly, it should be observed that this multiplier excludes the effects of manufactured goods exported on the non-manufacturing sector of the economy. In other words, an impact export multiplier greater than one might have resulted if the sum of both the effects on the manufacturing and non-manufacturing sectors were calculated.

Finally, this value of the multiplier may indicate a relatively high content of imports associated with the level of exports in the manufacturing sector. That is, it appears as if some of the income generated by additional

(20) See the model in Chapter III, pp. 65-66.

exports of manufactured goods is spent abroad within the same year, possibly for the purchase of new machinery and equipment to be used in the manufacturing process.

It should be pointed out again, however, that this multiplier measures only the impact of exports of manufactured goods on income of manufactures within the year these exports were made. Most probably the sum of the effects of these particular amounts of exports of year "t" on the income of all the following periods would have given a multiplier greater than one. This latter quantity is the "equilibrium export multiplier". (21)

g) Equilibrium Export Multipliers - National Level.

Table 11 gives the values which are used in calculating the equilibrium export multipliers, in constant and current dollars for the aggregate economy. The variables used are gross national product (lagged and unlagged values) and Z which is equivalent to the Z^* of page 65. The data are for the period 1920-1965 excluding the war years, 1942-1946.

According to the Third Model, page 68, the "equilibrium export multiplier" is given by $\frac{Y_2}{1-Y_1}$. This is equivalent to the ratio $\frac{f_2}{1-f_3}$ in the above mentioned Table 11. The values obtained are shown in Table 12.

(21) The creation of a model which could be used to calculate this quantity (for the manufacturing sector) presents some difficulties. For this reason, therefore, only the model for the aggregate economy equilibrium export multiplier has been formulated. See Chapter III, pp. 66-68.

Table 11

Equation	R ²	S	Constant	First Coefficient	Second Coefficient	D-W
$GNP_t = f_1 + f_2 Z_t + f_3 GNP_{t-1}$	.990	855.6	123.5	1.68 T(61.8)		1.064
Constant \$	.997	478.2	- 42.9	0.78 T(7.92)	0.56 T(9.20)	1.692
$GNP_t = f_1 + f_2 Z_t + f_3 GNP_{t-1}$	.997	850.0	560.8	1.63 T(108.1)		0.7933
Current \$.999	533.5	293.9	0.98 T(11.6)	0.43 T(7.71)	0.8943

(see text for explanations and Tables 15 and 16 for data).

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Table 12

Equilibrium Export Multipliers

Constant \$	1.81
Current \$	1.72

(see text for explanation).

The values of 1.81 for constant dollars (and 1.72 for current dollars) suggest that on the average every dollar exported has induced 1.81 dollars of GNP (or 1.72 in current dollars). Again, this is the total effect (i.e. ideally, the sum of all the effects of GNP over an infinite number of years) of the amount of goods and services exported in one year on the gross national product.

h) Summary of Findings

The net effect of exports of manufactured goods and of goods and services on output (i.e. manufacturing GDP and total GNP), can be measured, as already suggested, in at least two ways: i) by the impact multiplier; ii) by the equilibrium multiplier. Table 13 shows the different combinations of the possible values.

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Table 13

Item	Effect of Manufactured Goods Exported on:		Effect of Total Exports of Goods and Services on:	
	Manufacturing Industries GDP	GNP	Manufacturing Industries GDP	GNP
Impact Multiplier	0.92	n.c.	n.c.	1.16
Equilibrium Multiplier	n.c.	n.c.	n.c.	1.81

Note: the values are those calculated using constant dollars data.
n.c. means not calculated.

In this thesis only three of the eight quantities have been calculated. More definite conclusions on the impact of exports on the economy can only be reached after completion of the above Table. The three values obtained plus the analysis performed in this Chapter represent, however, a first attempt to examine a manufacturing sector variable (i.e. manufactured goods exported) within the context of the whole economy. (22)

(22) Some of the conclusions offered in this Chapter are supported by a recent study by R.F. Emery. (See, R.F. Emery, "The Relation of Exports and Economic Growth", Kyklos, 1967, Fasc 2).

CHAPTER V

SUMMARY AND CONCLUSIONS

This thesis has attempted to analyze the impact that exports have exerted on the Canadian economy and its industrial development during the last forty-five years. This study began by examining several factors affecting industrial growth, it then moved to a theoretical presentation of the problem, and finally showed the results obtained. What conclusions can be drawn from this analysis with regard to the long run behaviour of exports and income, and what are the implications for forecasting and possible policy recommendations?

a) Implications for Analysis

To begin with, both statistical and graphical analyses suggest that for the period examined, the relationship between exports and output has been relatively stable. In terms of the Friedman-Meiselman theory referred to in the third Chapter, this means that exports can be taken, at least in the Canadian case, as a better income determinant than investment.⁽¹⁾

(1) Note again that in this thesis investment has been defined as Business Gross Fixed Capital Formation. This is a limited concept and it differs from the one used in the Friedman-Meiselman analysis. (See, also, Chapter III, p. 56.)

Insofar as the manufacturing sector is concerned, similar conclusions on the importance of exports can also be reached. Here however, the choice between exports and investment as main income determinants becomes harder for the simple reason that the correlation between exports and investment within the sector is, as described above in pp. 76-77, very close.⁽²⁾

Secondly, this thesis has tried to differentiate between the purely "quantitative effect" and the "gestation period" of the export multipliers. In other words, it has attempted not only to measure the numerical value of the multiplier, but also to estimate the time period within which the change had taken place. On the basis of the analysis presented, it appears that there are two definite effects. The first one and larger of the two acts with a one year lag; the second one, smaller, affects income in a relatively short period of time. Specifically, this study suggests that an increase in exports of manufactured goods raises income in the manufacturing sector through a rapid change in investment. On the other hand, exports of non-manufactured goods seem to induce additional output only after a somewhat longer time lag. There are two main reasons for this lengthier process of income generation in response to changes in exports of non-manufactured goods.

(2) That is, because of the close correlation between exports and investment in manufacturing, it becomes almost impossible to decide which one is better in income determination analysis.

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The first one is that a considerable length of time must elapse between sales abroad of agricultural goods and new seeding and harvesting. In view of the importance of these exports in Canada's total export picture, the longer time lag in this agricultural-output multiplier is to be expected. The second reason is that the time involved between accrued earnings from foreigners and actual expenditures in the home market might be relatively long. This means that also in this case the export multiplier will require some time before taking place.

Thirdly, even though further analysis in depth is required, a preliminary conclusion based on the statistical analysis performed, points out closer correlation between exports of semi-manufactured goods and income than either exports of raw materials or finished goods. This result is somewhat unexpected because of the high labour content embedded in the fully manufactured goods. On further consideration, however, semi-manufactured goods are generally produced in industries with high capital-output ratio and therefore with high productivity and high wages. Furthermore, an increase in output (due to new exports) in one of these industries producing semi-manufactured goods will give rise to additional investments and therefore to an increase in output in those other industries producing machinery and equipment; i.e. here exports give rise to a rapid "spread effect" within

the manufacturing sector.⁽³⁾

Fourthly, and in the way of a broad summary, this study has attempted to examine over the long run three important variables of the manufacturing sector and of the aggregate economy. By estimating data, and simplifying analysis and models, it has tried to give a more complete picture of: trends, coefficients of correlation, and multipliers for exports, output and investment.

b) Implications for Forecasting

As suggested in the closing sentences of the previous chapter, this study has placed most of the emphasis on one economic variable, i.e. exports. However, because exports are examined within the realm of a long-run model, this analysis has certain limitations in its application to short-run economic forecasting. That is, to the extent that only average values were calculated (i.e. the average for the 1920-1965 period), the knowledge of an increase in exports in a specific year does not automatically suggest a corresponding income effect. One of the possible conclusions, insofar as prediction is concerned, could be based on the assumption that the export multiplier in any particular year equals the value obtained in the foregoing long run analysis.

The other limitations could perhaps be overcome by

(3) Note again that production at/or near full capacity must be assumed. (See pp. 77-78).

"adjusting" this long-run multiplier for short-run events; i.e. by allowing certain numerical values to be either added to, or subtracted from this average value. For example, depending upon factors such as the position in the business cycle of the Canadian economy, the economic situations faced by other major trading countries, and the propensities to consume and to import, the long-run average multiplier could be increased or diminished by appropriate amounts.

On the other hand, if more precise results are required, further research could be pursued by devising a short-run forecasting model. This project would require the construction of a quarterly, rather than a yearly model and the subdivision of the economy into finer units.⁽⁴⁾

This "disaggregation" within the industrial sector, however, would demand a refining of the central hypothesis of this thesis (i.e. the importance of exports in determining the GDP of certain manufacturing industries). In fact, there are industries such as clothing, footwear, etc., which are mainly devoted to supplying the home market. For these industries the effect of a rise in exports is therefore indirect. That is, income is generated through the

(4) That is, the economy should be subdivided not only into sectors, but also where possible, into subsectors. For example, manufacturing industries could be divided either into primary and secondary manufacturing, or durable and non-durable goods, or many other suitable subdivisions.

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increase in earnings and expenditures in the other sectors.

c) Implications for Policy

The implications of the results for policy recommendations are also tentative. Further analysis of the individual sectors of the economy is essential for a complete assessment of Canada's comparative advantage position in international trade.⁽⁵⁾ However, one suggestion which appears to be substantiated by the empirical evidence is to place particular emphasis on policies designed to encourage the growth of industries producing partially manufactured goods. For this thesis suggests that exports of such industries may have a greater impact on economic development than other sectors, as illustrated by the close correlation between exports of these industries and investment and value added in manufacturing.

Initially such policies may contribute to a worsening of the balance of payments for a short period of time due to an increase in the imports of machinery and equipment. The overall effect over the longer term, however, should more than offset the temporary adverse balance of payments

(5) For instance, an analysis of the agricultural sector, where Canada holds a position of comparative advantage, could have provided additional useful insight for policy considerations.

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implications because of the substantial net gains associated with the expansion of these particular industries. Together with increased investments there are, in fact the positive income effects arising both within the industries where additional capacity has been created, and in the economy as a whole, through the multipliers. Two reasons support this latter conclusion.

The first one is concerned with the manner in which exports of manufactured goods, in general, appear to affect the income of manufactures through rapid investment. It seems, thus, that in the industries where capital requirements are high (i.e. partially manufactured goods industries), the positive impact created by increased exports will be very large and it will act upon these industries in a relatively short period of time. The second reason refers to the high productivity^{OF LABOUR} and therefore high wages which are generally found in industries where the capital-output ratios are high. A change in exports will therefore be more fruitful in these industries where partially manufactured goods are produced than in others where non-manufactured or fully manufactured goods are to be produced. A side effect, of course, is that in the long run emulation by persons employed in the non-manufacturing sectors also leads to higher wages and salaries in these other sectors.

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d) Further Areas of Research

It should be observed, that the amount of manufactured goods exported does not depend only on the willingness of a country (i.e. Canada in this case) to supply products for sale. It is also a function of disposable income of foreigners, availability of substitutes, prices of goods (which are determined by costs of production, transportation, tariffs, supply-demand relationships in world markets, etc.) and other factors. Moreover, the adoption of either flexible or fixed exchange rates might affect trade and the other variables such as income, money supply, etc. in different ways. Thus, useful additional research could be extended to a comparison, based on the Canadian past experience, between multipliers during a flexible exchange rate and a fixed exchange rate period, for the different manufacturing industries and the other non-industrial sectors of the economy. For the aggregates, this type of analysis has already been performed by R. Rhomberg and published in a recent article.⁽⁶⁾

(6) R. Rhomberg, "A Model of the Canadian Economy under Fixed and Fluctuating Exchange Rates", Journal of Political Economy, February, 1964. One of the important conclusions of Rhomberg is that the effectiveness of policies, whether fiscal or monetary, seems in fact closely associated with the foreign trade sector, and those factors which affect it. In fact, "changes in money supply, other things being equal, tend to have a much more pronounced effect under fluctuating exchange rates than under fixed exchange rates, whereas the opposite is true of changes in government expenditures on goods and services". (op. cit., p. 30)

Additional research could also be extended to the short-run testing of the Freidman-Meiselman theory (perhaps by also adding the money supply variable to the analysis). Thus, further research could be devoted to a closer examination of the export-income function for shorter periods of time and these latter results compared to the income-investment and income-money supply relationships. This analysis, could also be extended to other countries: developed and underdeveloped, and with different degrees of dependence on foreign trade, and the results could again be usefully compared.

As other developed countries, Canada is pursuing policies encouraging the exports of fully manufactured goods. This thesis, as suggested above, points out that there are other goods (such as semi-manufactured goods) whose production and export are very fruitful to Canadian industrial development. Research could be thus pursued in developing a more complete analysis of the relationship between raw materials, fully manufactured goods and partially manufactured goods and income originating in manufactures.⁽⁷⁾ In the long run such a model might prove to be of considerable importance in the shaping of this country's foreign trade policies.

(7) Actually this further analysis could be enlarged to cover either certain particular industries or sets of products.

APPENDIX I

The first Appendix presents in graphical form some of the relationships already examined statistically in the previous Chapters.

All the values on the axes of Figures 1-9 are in constant (1949 = 100) dollars. The values on the vertical axes of Figure 10, on the other hand, are in current dollars.

The symbols used in Figures 1-10 represent the following variables:

- GNP: Gross National Product
- E: Exports of Goods and Services (unlagged)
- E-1: Exports of Goods and Services (lagged one year)
- I: Business Gross Fixed Capital Formation
(unlagged)
- I-1: Business Gross Fixed Capital Formation
(lagged one year)
- Q: Gross Domestic Product of Manufactures
- EQ: Exports of Manufactured Goods (unlagged)
- EQ-1: Exports of Manufactured Goods (lagged one year)
- IQ: Investment in Manufacturing Industries
- NI: Net National Income.

It should be noted that Figures 1-5 are based on

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data given in Table 15. Figures 6-9 are based on data shown in Table 18. Data for Figure 10 are from Tables 15 and 17.

The data cover the period 1920-1965 and exclude the war years 1942-1946.⁽¹⁾

(1) For Figure 10, however, the data cover the whole period, 1920-1965.

Figure 1

Gross National Product Expressed as a Function of Exports
of Goods and Services

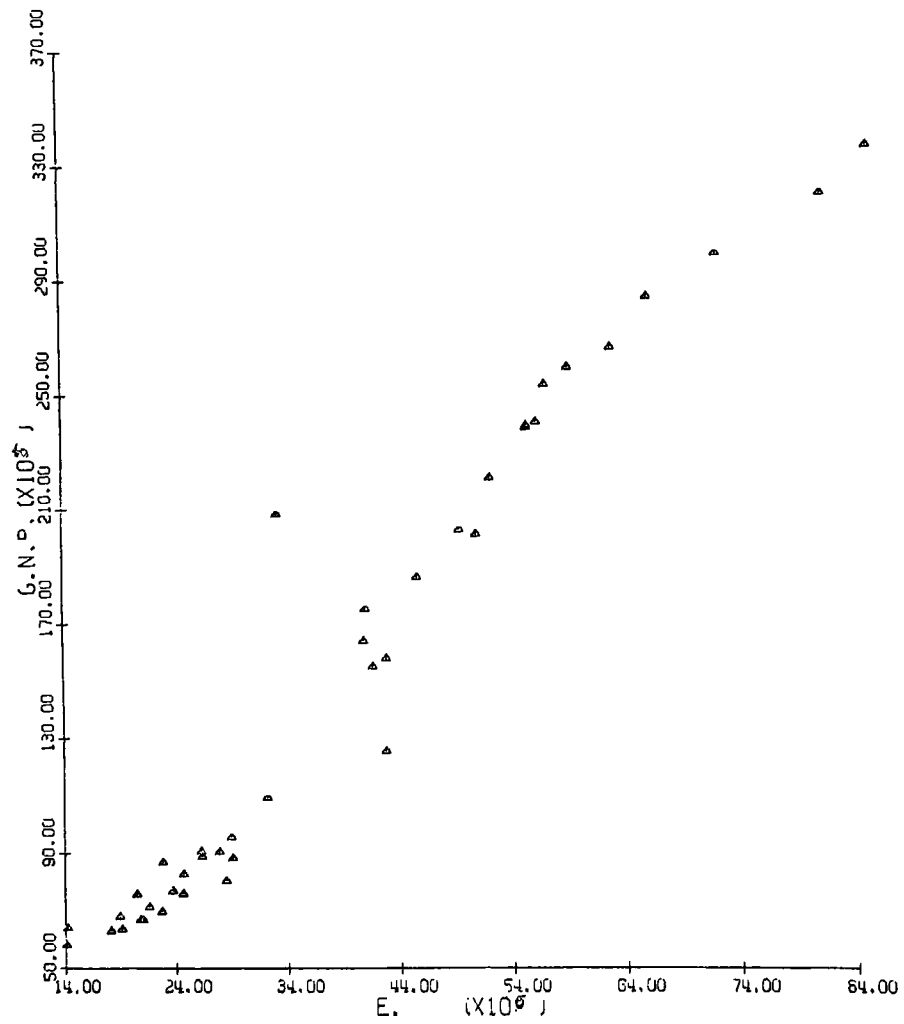


Figure 2
Gross National Product Expressed as a Function of Lagged
Exports of Goods and Services

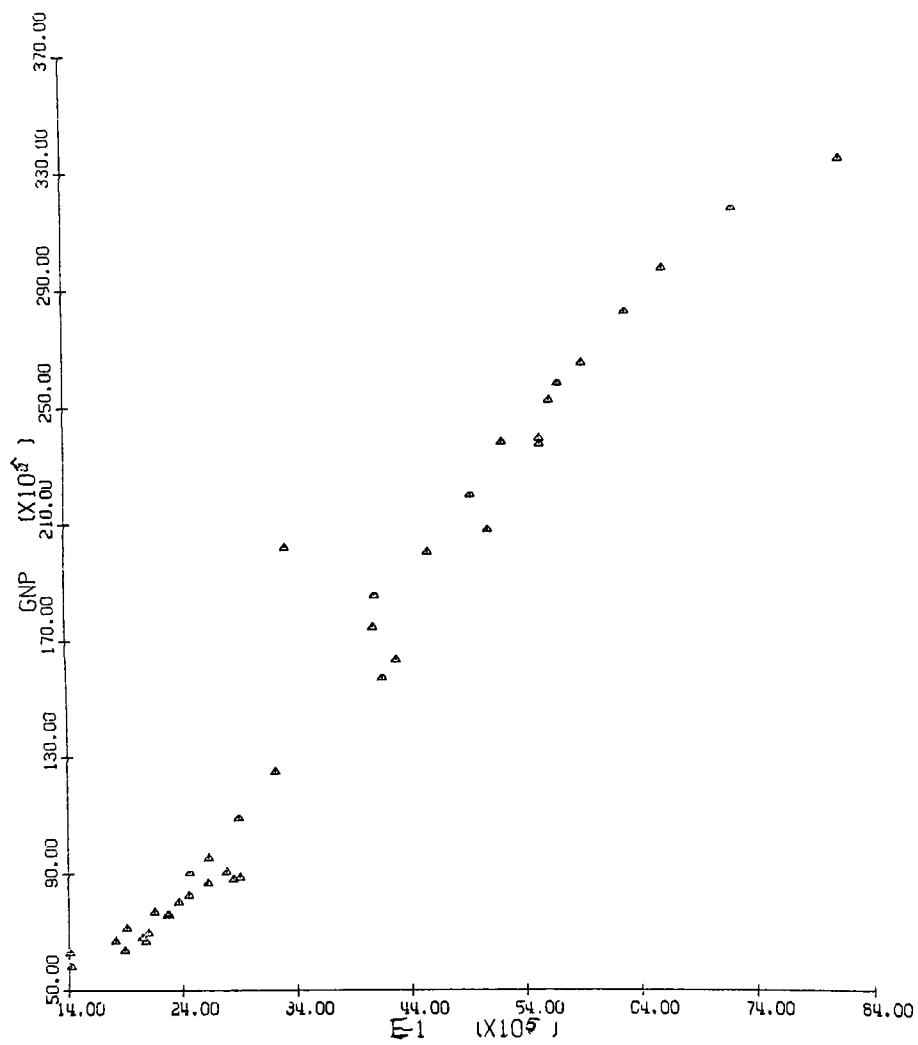


Figure 3

Gross National Product Expressed as a Function of Business
Gross Fixed Capital Formation

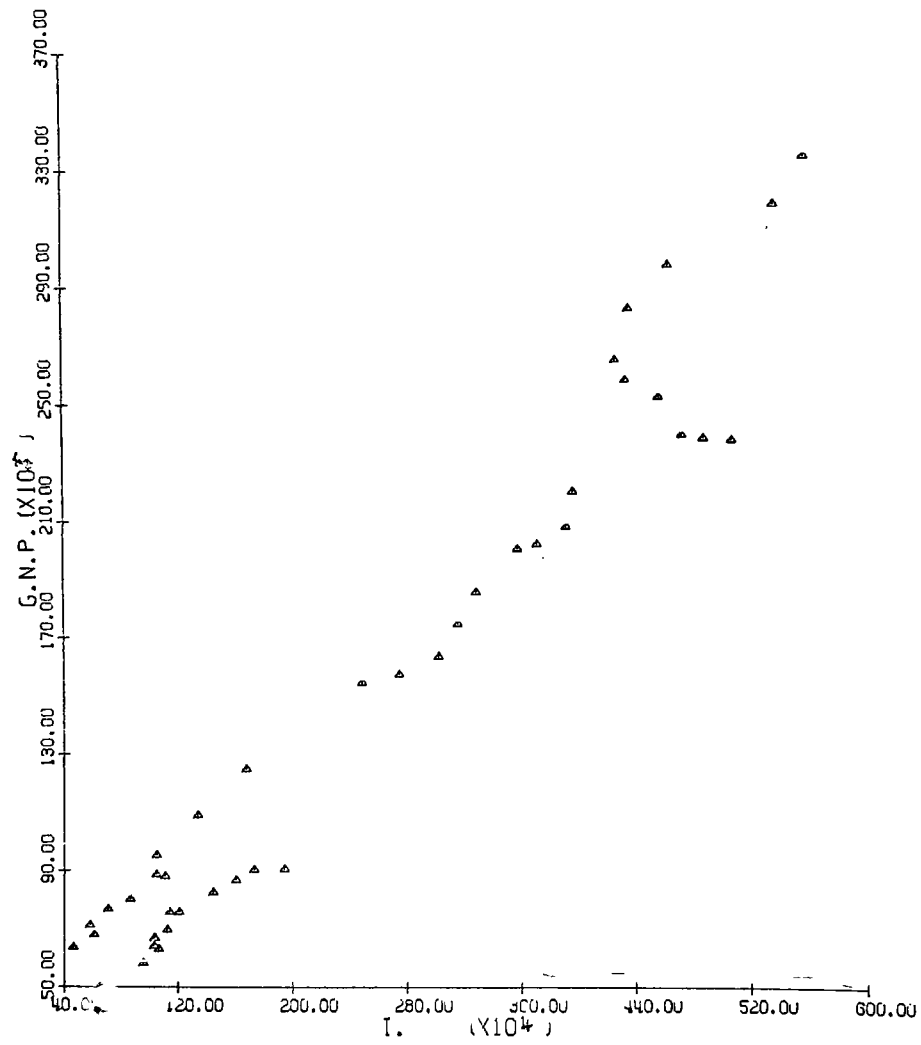


Figure 4
Gross National Product Expressed as a Function of Lagged
Business Gross Fixed Capital Formation

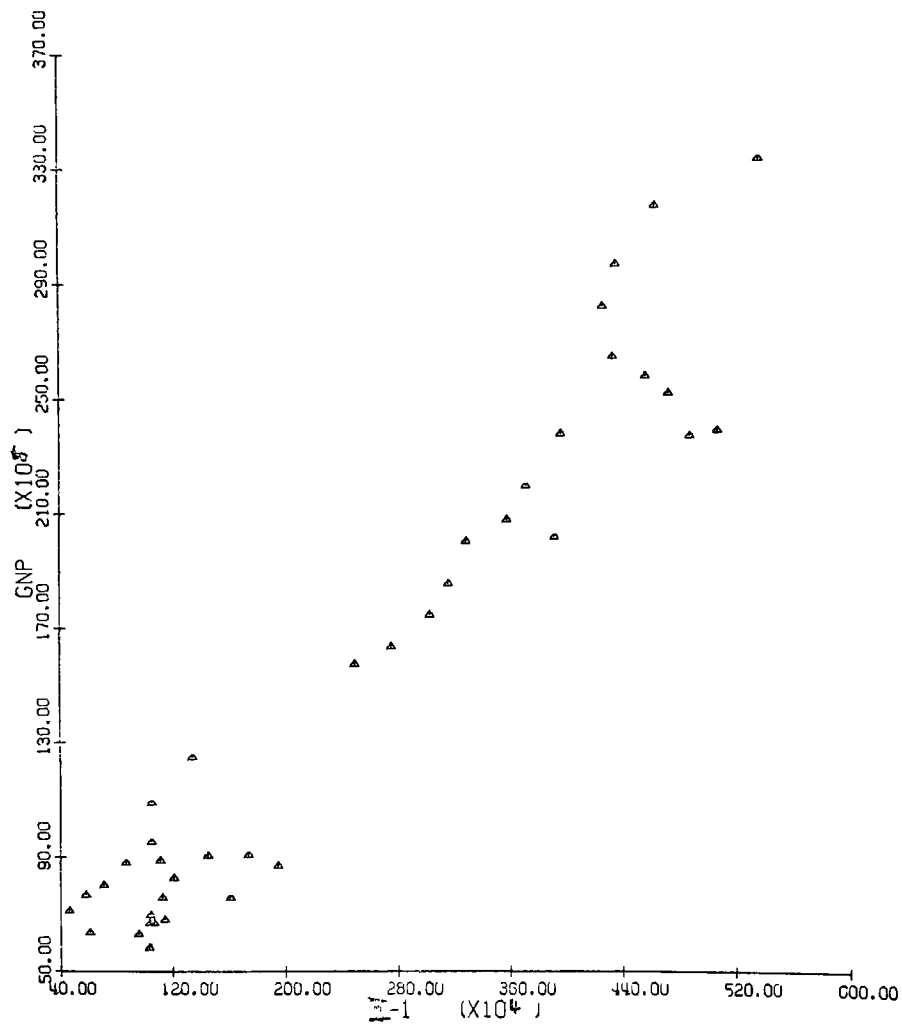


Figure 5

Business Gross Fixed Capital Formation Expressed as a
Function of Exports of Goods and Services

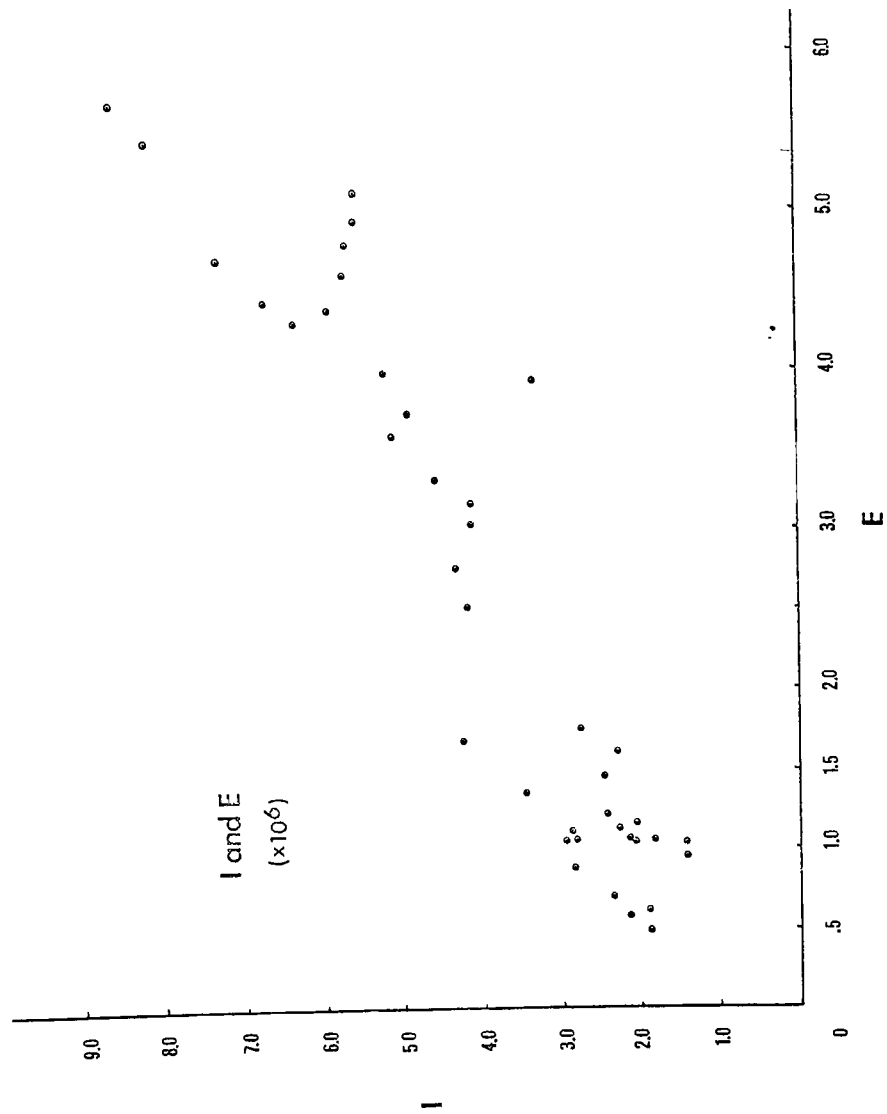


Figure 6

Gross Domestic Product of Manufactures Expressed as a
Function of Exports of Manufactured Goods

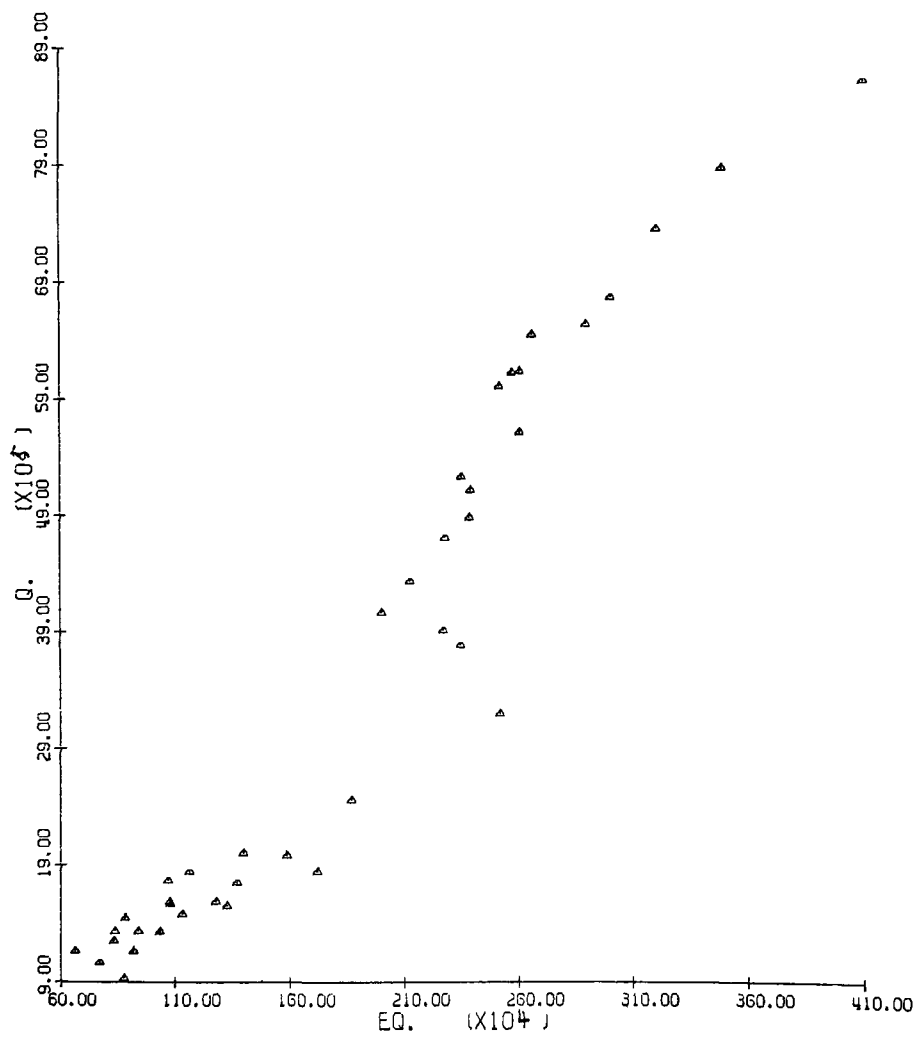


Figure 7

Gross Domestic Product of Manufactures Expressed as a
Function of Lagged Exports of Manufactured Goods

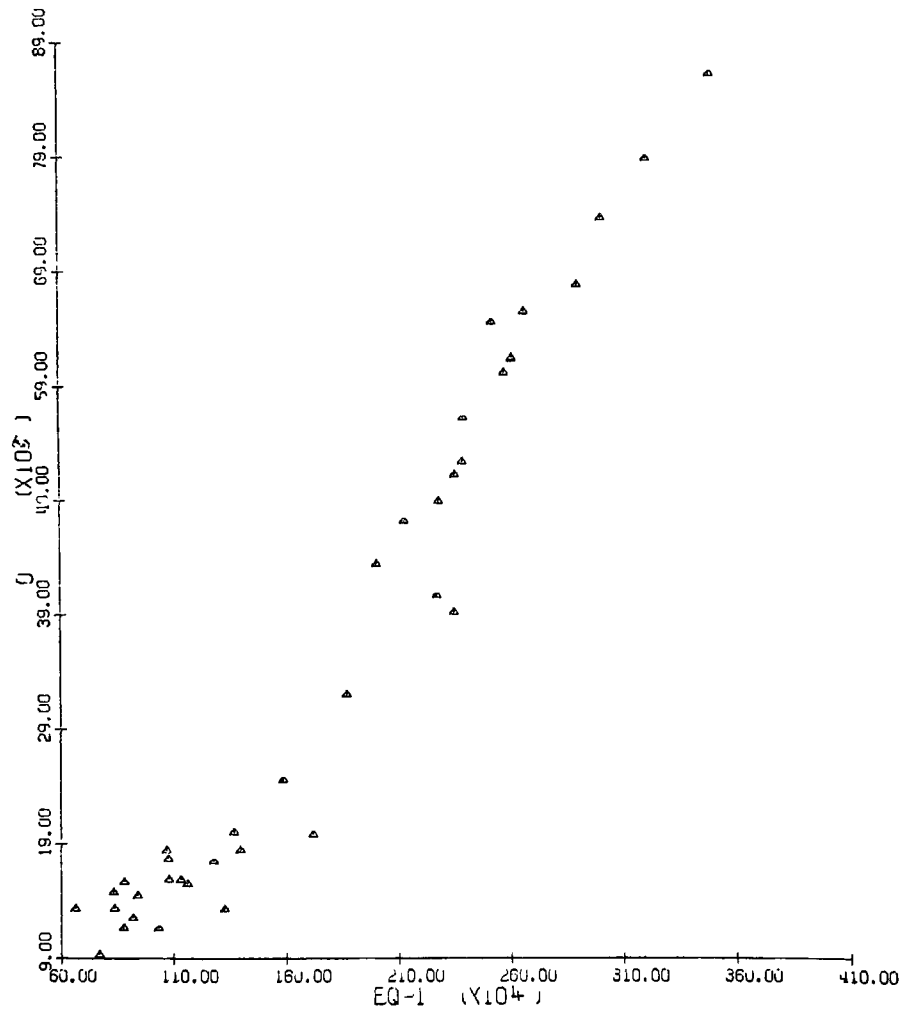


Figure 8

Gross Domestic Product of Manufactures Expressed as a
Function of Investment in Manufacturing Industries

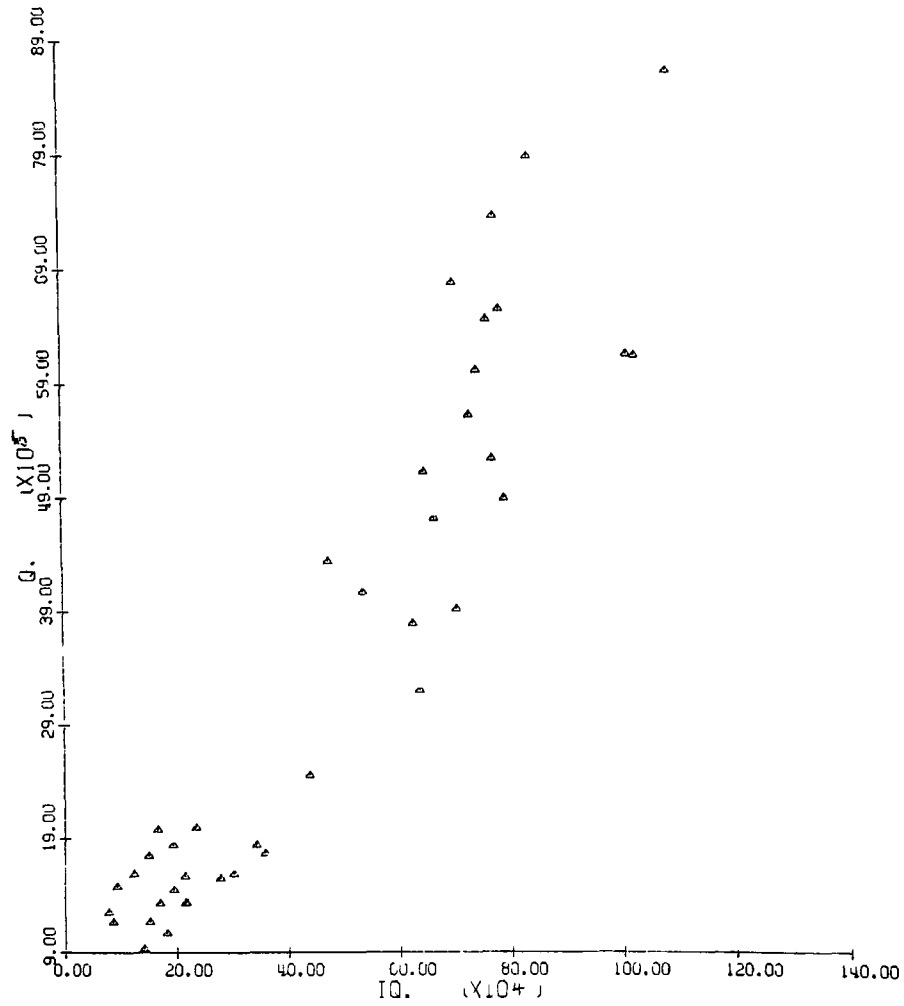


Figure 9

Investment in Manufacturing Industries Expressed as a
Function of Exports of Manufactured Goods

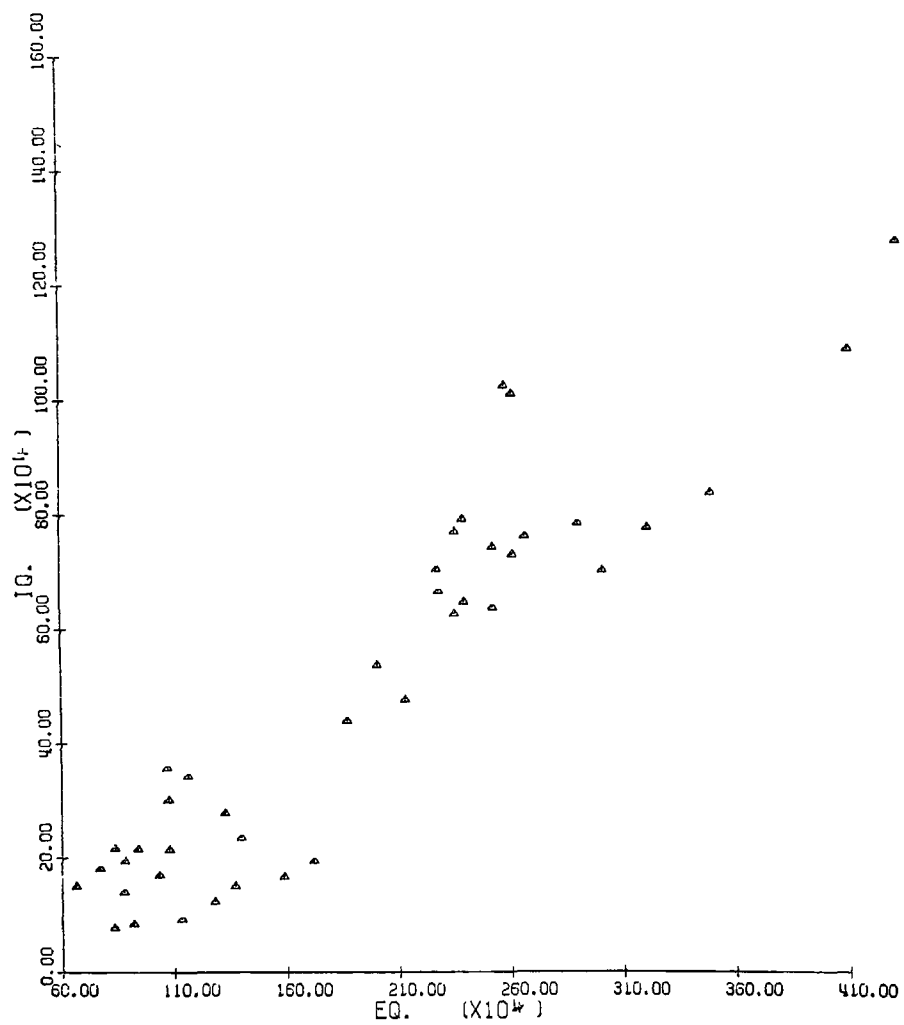
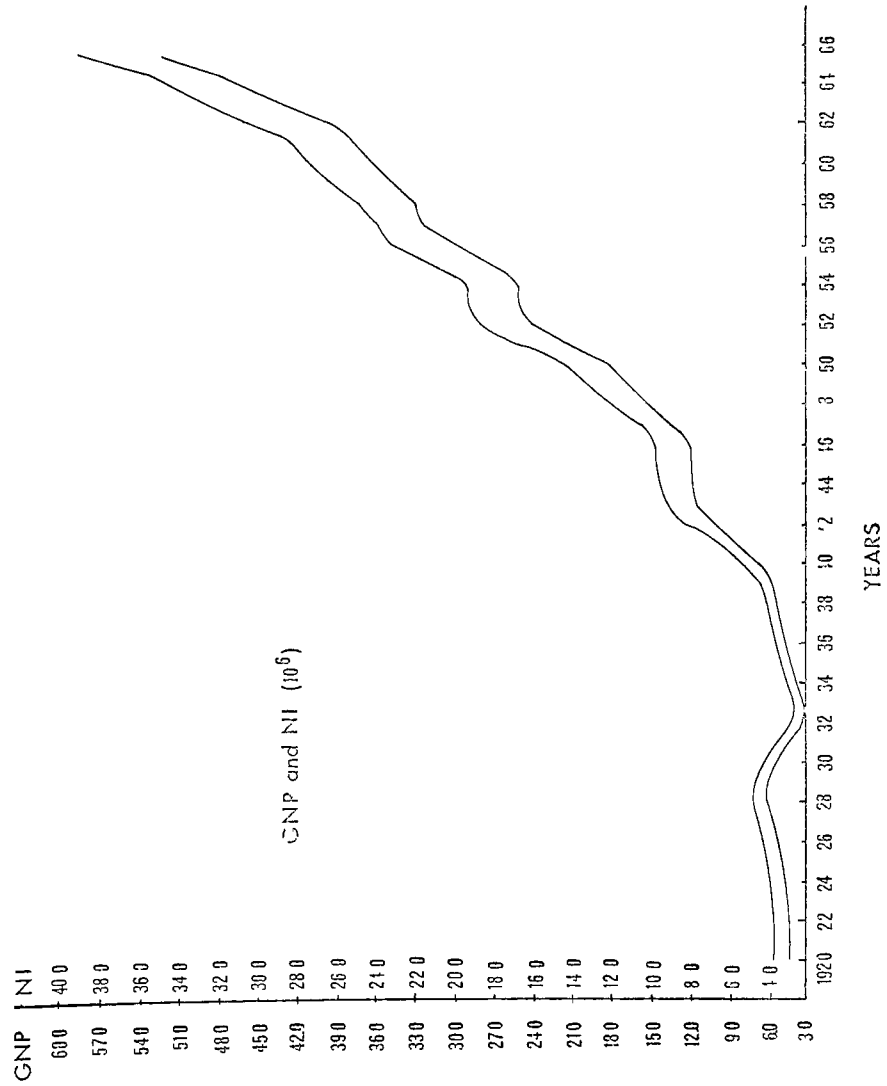


Figure 10
 Gross National Product and Net National Income in Canada,
 1920-1965



APPENDIX II

This Appendix contains all of the data used for the statistical analyses in the previous Chapters. The Sources of Data and Method of Estimations are also included.

Table 14

VALUE ADDED BY MANUFACTURE, PERSONAL DISPOSABLE INCOME, AND POPULATION,
CANADA, 1920-1965

Year	Value Added by Manufacture		Personal Disposable Income		Population (in Thousands)
	Millions Current \$	Millions Constant \$(1)	Millions Current \$	Millions Constant \$	
1920	1621	1589	4143	4926	8,691
1921	1124	1485	3151	4185	8,865
1922	1103	1684	3279	4698	8,972
1923	1206	1794	3493	4990	9,087
1924	1075	1617	3322	4821	9,232
1925	1168	1725	3776	5441	9,385
1926	1305	2002	3961	5603	9,451
1927	1428	2270	4175	5981	9,637
1928	1598	2582	4495	6385	9,835
1929	1755	2896	4540	6376	10,029
1930	1523	2677	4267	6061	10,208
1931	1252	2566	3552	5533	10,376
1932	956	2101	2951	5002	10,510
1933	920	2009	2721	4807	10,633
1934	1089	2278	3070	5339	10,741
1935	1153	2427	3268	5654	10,845
1936	1290	2676	3452	5871	10,950
1937	1509	2880	3895	6438	11,045
1938	1498	2881	3953	6428	11,152
1939	1531	2990	4178	6827	11,267
1940	1942	3518	4775	7484	11,381
1941	2608	4371	5555	8133	11,507
1942	3310	5330	6898	9648	11,654
1943	3816	5991	7344	9991	11,795
1944	4016	6198	8027	10803	11,946
1945	3564	5466	8311	11052	12,072
1946	3467	5003	8923	11469	12,292
1947	4292	5266	9584	11236	12,551
1948	4939	5113	11079	11481	12,823
1949	5330	5330	11849	11849	13,447
1950	5942	5612	12688	12283	13,712
1951	6941	5703	14794	12988	14,009
1952	7444	6428	16072	13737	14,459
1953	7993	6956	16904	14460	14,845
1954	7902	7024	16984	14332	15,287
1955	8753	7767	18329	15467	15,698
1956	9605	8266	20153	16697	16,081
1957	9882	8276	21107	16899	16,589
1958	9792	8187	22646	17678	17,048
1959	10221	8426	23948	18436	17,483
1960	10550	8676	25075	19112	17,870
1961	10857	8848	26011	19675	18,223
1962	11927	9542	28243	21093	18,570
1963	12764	10003	30018	22104	18,896
1964	13918	10814	31725	23006	19,235
1965	15029	11464	34990	24886	19,785

(1) Note: All the constant dollar figures in these Tables refer to 1949 = 100.

Table 15

GROSS NATIONAL PRODUCT, EXPORTS OF GOODS AND SERVICES, AND BUSINESS GROSS FIXED
CAPITAL FORMATION, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965

Year	GNP		Exports of Goods and Services		Business Gross Fixed Capital Formation	
	Millions Current \$	Millions Constant \$	Millions Current \$	Millions Constant \$	Millions Current \$	Millions Constant \$
1920	5457	6406	1565	1421	860	1032
1921	4361	5825	1071	1409	673	956
1922	4324	6299	1151	1813	651	1067
1923	4556	6691	1310	2076	671	1035
1924	4556	6683	1353	2101	654	1041
1925	4862	6970	1591	2270	682	1127
1926	5152	7576	1665	2459	702	1208
1927	5542	8259	1633	2467	830	1449
1928	6046	9037	1788	2789	1007	1736
1929	6134	9061	1646	2625	1161	1948
1930	5728	8679	1297	2283	926	1608
1931	4699	7567	972	2046	622	1143
1932	3827	6798	808	1892	319	609
1933	3510	6359	829	1910	234	462
1934	3984	7127	1020	2156	298	580
1935	4315	7678	1145	2371	369	708
1936	4653	8022	1430	2849	458	866
1937	5257	8809	1593	2907	633	1112
1938	5278	8871	1361	2632	592	1050
1939	5636	9536	1457	2897	592	1053
1940	6743	10911	1776	3223	803	1343
1941	8328	12486	2458	4282	1085	1682
1942	10327	14816	3376	5507	1064	1567
1943	11088	15357	4064	6301	887	1234
1944	11850	15927	4557	6614	900	1235
1945	11835	15552	4456	6267	1031	1420
1946	11850	15251	3365	4314	1388	1846
1947	13165	15452	3748	4169	2085	2497
1948	15120	15734	4147	4293	2619	2757
1949	16343	16343	4089	4089	3032	3032
1950	18006	17465	4297	4108	3348	3167
1951	21170	18554	5311	4571	3959	3294
1952	23995	20029	5858	5098	4451	3587
1953	25020	20798	5737	3328	4998	3926
1954	24871	20188	5520	4951	4779	3722
1955	27132	22005	6072	5225	5210	3974
1956	30585	23820	6621	5555	6774	4891
1957	31773	23747	6625	5553	7335	5087
1958	32606	23940	6565	5640	6975	4738
1959	34915	25246	6855	5717	6894	4575
1960	36287	25845	7153	5926	6692	4345
1961	37471	26519	7734	6308	6635	4272
1962	40575	28275	8383	6632	6960	4369
1963	43424	29742	9262	7242	7591	4646
1964	47403	31771	10676	8162	9103	5377
1965	51996	33395	11367	8559	10424	5586

Table 16

GROSS DOMESTIC PRODUCT, PERSONAL EXPENDITURE ON CONSUMER GOODS AND SERVICES, GOVERNMENT EXPENDITURE ON GOODS AND SERVICES, DOMESTIC GROSS FIXED CAPITAL FORMATION⁽²⁾, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965

Year	Gross Domestic Product		Personal Expenditure on Consumer Goods and Services		Government Expenditure on Goods and Services		Domestic Gross Fixed Capital Formation	
	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars
1920	5134	6025	3817	4539	519	618	1289	1325
1921	3905	5214	3048	4048	415	561	986	1259
1922	4058	5415	3014	4318	411	607	919	1360
1923	4329	6357	3166	4523	434	632	912	1297
1924	4117	6037	3158	4583	434	644	853	1254
1925	4680	6039	3362	4844	453	673	849	1300
1926	4904	7212	3542	5010	488	792	837	1461
1927	5183	7724	3893	5577	531	868	1083	1897
1928	5637	8426	4314	6128	560	908	1166	2068
1929	5686	8399	4621	6490	640	1027	1213	2057
1930	5399	8180	4367	6203	721	1178	1003	1863
1931	4310	6940	3773	5877	688	1160	527	834
1932	3482	6185	3194	5414	584	1041	219	438
1933	3122	5656	2984	5272	462	842	143	220
1934	3516	6990	3182	5534	503	916	330	585
1935	3836	6826	3338	5775	542	971	408	815
1936	4158	7169	3549	6036	544	961	386	631
1937	4707	7898	3884	6420	619	1056	642	1178
1938	4846	8145	3897	6337	666	1127	649	1324
1939	5122	8667	3984	6510	683	1156	874	1752
1940	6074	9828	4488	7034	1116	1794	1058	2001
1941	7424	11130	5103	7471	1635	2531	1173	1750
1942	9344	13406	5500	7692	3674	5189	1199	1903
1943	10041	13907	5808	7902	4177	5714	707	925
1944	10781	14491	6274	8444	4978	6499	755	1031
1945	10804	14197	6969	9267	3656	4542	720	958
1946	10791	13888	8031	10323	1796	2294	1721	2382
1947	11857	13917	9090	10657	1541	1850	2488	2942
1948	13699	14255	10085	10451	1797	1902	2732	2845
1949	14885	14885	10923	10923	2127	2127	3081	3081
1950	16458	15963	12026	11642	2344	2242	3898	3728
1951	19126	16762	13460	11817	3271	2806	4873	4150
1952	21344	17816	14781	12633	4279	3516	4963	4077
1953	22206	18459	15592	13338	4432	3517	5581	4516
1954	22213	18030	16175	13650	4461	3415	4649	3507
1955	24169	19729	17464	14738	4780	3550	5491	4374
1956	27189	21175	18833	15603	5386	3794	7858	5846
1957	28298	21149	19964	15984	5738	3832	7545	5223
1958	29045	21325	21035	16421	6161	3985	6540	4358
1959	31175	22542	22591	17392	6490	4155	7251	4883
1960	32336	23031	23540	17945	6769	4197	7102	4706
1961	33351	23603	24466	18508	7236	4393	6665	4298
1962	36137	25173	25926	19351	7717	4549	7492	4839
1963	38697	26329	27487	20175	8075	4551	8126	5066
1964	41702	27741	29666	21336	8654	4755	9489	5618
1965	45662	29331	32063	22616	9596	5040	11372	6437

(2), Domestic Gross Fixed Capital Formation is defined as Business Gross Fixed Capital Formation plus Value of Physical Change of Inventories (as per National Accounts).

Table 17

NET NATIONAL INCOME, PERSONAL INCOME, AND IMPORTS OF GOODS AND SERVICES,
IN CURRENT DOLLARS, CANADA, 1920-1965

Year	Net National Income	Personal Income	Imports of Goods and Services
	Millions \$	Millions \$	Millions \$
1920	4323	4202	1924
1921	3288	3196	1270
1922	3702	3598	1153
1923	3645	3543	1341
1924	3466	3369	1223
1925	3940	3830	1339
1926	4129	4014	1538
1927	4356	4234	1643
1928	4737	4554	1820
1929	4708	4608	1957
1930	4399	4338	1634
1931	3382	3615	1146
1932	2641	3015	904
1933	2368	2790	831
1934	2783	3134	952
1935	3099	3348	1020
1936	3367	3547	1186
1937	3887	4007	1413
1938	4001	4068	1261
1939	4236	4290	1331
1940	5063	4914	1627
1941	6305	5851	1967
1942	8098	7393	2275
1943	8802	8042	2858
1944	9583	8865	3539
1945	9665	9120	2910
1946	9551	9719	3002
1947	10361	10375	3699
1948	12003	11901	3696
1949	12905	12638	3912
1950	14161	13428	4631
1951	16588	15824	5828
1952	18654	17395	5694
1953	19294	18336	6180
1954	19032	18421	5952
1955	20683	19820	6770
1956	23166	21885	7987
1957	23860	23024	8025
1958	24702	24440	7650
1959	26482	26036	8359
1960	27433	27435	8396
1961	28250	28522	8716
1962	30653	30972	9257
1963	32869	32934	9804
1964	35437	35153	11109
1965	38819	38902	12503

Table 18

GROSS DOMESTIC PRODUCT OF MANUFACTURES, TOTAL DOMESTIC EXPORTS, EXPORTS OF MANUFACTURED GOODS⁽³⁾, AND INVESTMENT IN MANUFACTURING INDUSTRIES, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965

Year	Gross Domestic Product of Manufactures		Total Domestic Exports		Exports of Manufactured Goods		Investment in Manufacturing Industries	
	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars	Millions Current Dollars	Millions Constant Dollars
1920	1091	1070	1268	1194	799	770	152	182
1921	705	932	800	1050	665	878	99	141
1922	765	1168	880	1381	411	663	92	151
1923	896	1334	1002	1583	515	837	141	217
1924	887	1334	1030	1594	592	940	136	216
1925	981	1449	1240	1766	592	881	118	195
1926	1063	1571	1261	1854	701	1080	129	215
1927	1148	1591	1211	1851	676	1078	179	302
1928	1255	1770	1339	2115	654	1070	215	358
1929	1341	1844	1152	1849	707	1163	225	343
1930	1246	1551	864	1652	691	1326	163	278
1931	966	1331	588	1355	486	1034	95	170
1932	728	1164	490	1256	374	919	47	85
1933	648	1253	529	1370	324	833	42	78
1934	786	1481	649	1575	454	1132	50	93
1935	882	1587	725	1726	519	1279	67	123
1936	987	1750	938	2117	585	1370	83	150
1937	1170	2002	997	1928	681	1398	140	235
1938	1174	1844	837	1836	786	1720	115	194
1939	1260	1982	825	1892	687	1587	98	166
1940	1622	2454	1179	2441	918	1870	274	439
1941	2220	3203	1621	3229	1299	2522	430	637
1942	2889	3911	2364	4444	2064	3801	446	629
1943	3198	4233	2971	5036	2453	4158	277	369
1944	3171	4318	3440	5260	2676	4130	211	282
1945	2960	3781	3218	4691	2360	3496	280	380
1946	2816	3467	2312	2991	1669	2182	337	445
1947	3310	3793	2775	3129	2108	2350	528	626
1948	3909	3919	3075	3177	2240	2274	573	705
1949	4303	4070	2993	2993	2004	2002	536	536
1950	4714	4342	3118	2975	2231	2129	502	475
1951	5474	4717	3914	3286	2740	2283	793	666
1952	6150	4892	4301	3648	2883	2390	973	792
1953	6453	5246	4117	3596	2769	2355	969	770
1954	6291	5128	3881	3484	2790	2395	822	647
1955	6779	5629	4282	3759	3104	2613	947	730
1956	7605	6154	4790	4077	3240	2613	1394	1012
1957	7869	6142	4839	4132	3211	2579	1479	1026
1958	7653	6024	4826	4135	3092	2522	1095	743
1959	8286	6471	5022	4224	3314	2668	1144	762
1960	8427	6561	5256	4413	3611	2905	1201	785
1961	8501	6793	5755	4796	3759	3014	1085	702
1962	9320	7375	6178	4982	4079	3214	1269	777
1963	9866	7892	6798	5457	4467	3498	1358	838
1964	10857	8624	8094	6398	5324	4105	1815	1087
1965	11723	9365	8523	6648	5720	4320	2230	1273

(3) Defined here as the sum of partially and fully manufactured goods exports.

Table 19

VALUE OF FACTORY SHIPMENTS, TOTAL IMPORTS, IMPORTS OF MANUFACTURED GOODS, CONSTRUCTION,
AND MACHINERY AND EQUIPMENT IN MANUFACTURING INDUSTRIES, IN CURRENT DOLLARS,
CANADA, 1920-1965

Year	Value of Factory Shipments ⁽⁴⁾ Millions \$	Total Imports Millions \$	Imports of Manufactured Goods Millions \$	Construction in Manufacturing Industries Millions \$	Machinery & Eqpt in Manufacturing Industries Millions \$
1920	3706	1337	770	62	90
1921	2489	799	930	37	62
1922	2376	762	531	37	55
1923	2663	903	575	59	90
1924	2570	808	639	55	81
1925	2817	890	576	49	70
1926	3101	1001	671	56	74
1927	3257	1077	767	87	92
1928	3582	1211	825	122	93
1929	3883	1287	975	131	94
1930	3280	996	960	76	88
1931	2555	619	700	41	54
1932	1980	445	433	19	28
1933	1954	397	288	18	24
1934	2394	510	303	20	30
1935	2654	547	364	21	46
1936	3002	628	397	38	45
1937	3625	798	477	64	76
1938	3338	665	577	45	70
1939	3475	736	481	33	65
1940	4529	1023	819	85	190
1941	6076	1274	1141	129	301
1942	7554	1505	1302	161	284
1943	8733	1686	1333	85	193
1944	9074	1729	1340	61	150
1945	8250	1514	1157	76	204
1946	8036	1841	1324	132	205
1947	10081	2543	1928	185	343
1948	11875	2618	1882	181	392
1949	12480	2714	2024	157	379
1950	13817	3125	2274	135	367
1951	16392	4005	2999	268	525
1952	16983	3916	3060	344	629
1953	17785	4248	3436	325	644
1954	17554	3967	3175	288	535
1955	19514	4568	3699	345	602
1956	21637	5547	4549	488	906
1957	22184	5473	4468	520	959
1958	22163	5050	4146	398	697
1959	23312	5509	4574	374	770
1960	23280	5483	4505	355	846
1961	24243	5769	4771	279	806
1962	26713	6258	5874	346	886
1963	28943	6558	5380	355	1003
1964	31560	7488	6227	445	1371
1965	34080	8633	7324	545	1685

(4) In the years preceding 1952 this quantity was called "Gross Value of Products".

Table 20

EXPORTS OF RAW MATERIALS IN CURRENT AND CONSTANT DOLLARS, AND EXPORTS OF PARTIALLY MANUFACTURED GOODS AND FULLY MANUFACTURED GOODS
IN CURRENT DOLLARS, CANADA, 1920-1965

Year	Exports of Raw Materials		Exports of Partially Manufactured Goods	Exports of Fully Manufactured Goods
	Millions Current \$	Millions Constant \$	Millions Current \$	Millions Current \$
1920	441	393	185	614
1921	524	678	194	471
1922	329	485	107	304
1923	416	618	151	364
1924	453	660	176	416
1925	477	618	161	430
1926	620	826	194	506
1927	578	805	185	490
1928	580	846	195	459
1929	661	1003	200	507
1930	429	815	213	478
1931	313	896	134	352
1932	226	645	110	263
1933	204	539	121	203
1934	211	482	211	244
1935	238	533	233	285
1936	264	550	261	324
1937	380	646	296	384
1938	285	629	355	430
1939	239	538	309	379
1940	261	563	337	581
1941	322	683	427	872
1942	299	589	488	1577
1943	519	878	498	1955
1944	763	1142	488	2188
1945	858	1203	536	1824
1946	603	757	512	1197
1947	645	740	722	1408
1948	812	869	818	1445
1949	971	971	731	1291
1950	873	831	977	1269
1951	1157	988	1260	1497
1952	1399	1247	1241	1661
1953	1328	1236	1189	1600
1954	1070	1070	1275	1536
1955	1155	1118	1515	1612
1956	1520	1474	1543	1727
1957	1578	1568	1475	1786
1958	1699	1643	1318	1806
1959	1707	1608	1454	1861
1960	1644	1544	1641	1971
1961	1996	1836	1630	2129
1962	2099	1800	1793	2286
1963	2331	1992	1952	2515
1964	2770	2341	2329	2995
1965	2803	2373	2566	3154

Table 21

EXPORTS OF CRUDE MATERIALS, FABRICATED MATERIALS, AND END PRODUCTS, IN CURRENT AND
CONSTANT DOLLARS, CANADA, 1946-1965

Year	Exports of Crude Materials		Exports of Fabricated Materials		Exports of End Products	
	Millions Current \$	Millions Constant \$	Millions Current \$	Millions Constant \$	Millions Current \$	Millions Constant \$
1946	613	770	1072	1381	581	793
1947	674	774	1485	1595	590	733
1948	859	920	1574	1560	613	665
1949	1004	1004	1447	1447	518	518
1950	928	884	1731	1645	435	419
1951	1221	1044	2143	1761	518	446
1952	1463	1305	2219	1826	587	496
1953	1408	1311	2110	1794	568	481
1954	1151	1151	2182	1886	516	435
1955	1262	1222	2519	2104	465	399
1956	1637	1588	2598	2088	511	415
1957	1685	1675	2551	2101	543	409
1958	1766	1708	2391	2011	634	478
1959	1805	1701	2694	2279	593	422
1960	1772	1664	2874	2438	610	431
1961	2132	1961	2916	2450	706	503
1962	2242	1923	3059	2526	878	615
1963	2490	2128	3265	2674	1043	727
1964	2959	2501	3714	2993	1421	978
1965	2995	2536	3924	3112	1604	1075

Table 22

IMPORTS OF CRUDE MATERIALS, FABRICATED MATERIALS, AND END PRODUCTS
 IN CURRENT DOLLARS, CANADA, 1946-1965

Year	Imports of Crude Materials Millions \$	Imports of Fabricated Materials Millions \$	Imports of End Products Millions \$
1946	571	570	697
1947	691	822	1028
1948	827	839	953
1949	772	856	1086
1950	950	949	1226
1951	1129	1238	1638
1952	936	1151	1830
1953	895	1218	2135
1954	864	1132	1971
1955	961	1312	2295
1956	1118	1670	2759
1957	1115	1669	2689
1958	985	1464	2601
1959	1029	1551	2928
1960	1061	1495	2927
1961	1109	1557	3103
1962	1205	1662	3391
1963	1302	1820	3436
1964	1401	2051	4036
1965	1455	2325	4853

SOURCES OF DATA AND METHOD OF ESTIMATION

This section describes the sources of data as well as the method used in estimating several sets of figures incorporated in the previous tables.

TABLE 14 - VALUE ADDED BY MANUFACTURE, PERSONAL DISPOSABLE INCOME, AND POPULATION, CANADA, 1920-1965.

Column (1): Data of Value Added by Manufacture, in current dollars, for 1920-1959, are from: General Review of the Manufacturing Industries of Canada, 1960, Dominion Bureau of Statistics (henceforth DBS), 1964; data for 1960 and 1961 are special estimates based on Survey of Production, 1962, DBS, Ottawa, 1965. These estimates as well as the two following sets of estimates are based on the assumption that the change in classification in 1959 and in 1961 have produced "constant" changes in the following years. Data for 1962 and 1963 are based on Advance Statement, Summary Statistics of Manufacturing Industries, 1963, DBS, Ottawa, March 11, 1966; data for 1964 and 1965 are special estimates based on Inventories, Shipments, and Orders in Manufacturing Industries, March 1966, DBS, Ottawa, 1966. These latter figures are based on the additional assumption that the ratio between Value Added by Manufactures and Value of Factory Shipments can be taken as constant.

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Column (2): Data of Value Added by Manufacture for the years 1920-1960, in constant dollars, were calculated by deflating the current dollars values (column (1)) by the wholesale price index, according to degree of manufacture, in M.C. Urquhart, ed., Historical Statistics of Canada, The MacMillan Co. of Canada Ltd., Toronto, 1965, p. 297. Values for 1961-1965 were deflated using similar indexes from the Canadian Statistical Review, DBS, Ottawa, issues of the month of May for the years 1962, 1964, 1965 and 1966. These indices were all changed to 1949 = 100, by simple ratio operations.

Column (3): Data on Personal Disposable Income, in current dollars, for 1920-1925 are special estimates based on Total Net Domestic Income, p. 138 of M.C. Urquhart, ed., op. cit., These estimates assume a constant ratio between Total Net Domestic Income and Net National Income and Personal Disposable Income for the years 1920-1926. The year 1926 has provided the basis for calculating the ratio between these variables. The data for 1926 as well as for the following years to 1955 are from National Accounts, Income and Expenditure,⁽¹⁾ 1926-1956, DBS, Ottawa, 1958; data for 1956-1958 are from National Accounts, 1959, DBS, Ottawa, 1960; data for 1959 and 1960 are from National Accounts, 1963, DBS, Ottawa, 1964; data for 1961-1965 are from National Accounts, Fourth Quarter and Preliminary Annual,

(1) Here-after referred to as National Accounts.

1965, DBS, Ottawa, 1966.

Column (4): Data of Personal Disposable Income, in constant dollars, for the years 1920-1925, were calculated by deflating the current dollar values by special indices. These indices were taken from the working papers of O.J. Firestone, Canada's Economic Development, 1867-1953, Bowes and Bowes, London, 1958.⁽²⁾ Values for 1926-1965 were deflated using the Implicit Price Index for "Personal Expenditures on Consumer Goods and Services"; for National Accounts issues of 1926-1956, 1959, 1963 and 1965 were used for these indices.

Column (5): Data of Population for 1920-1925 are from O.J. Firestone, op. cit., p. 241; data for 1926-1965 are from National Accounts issues: 1926-1956, 1959, 1963, 1965.

TABLE 15 - GROSS NATIONAL PRODUCT, EXPORTS OF GOODS AND SERVICES, AND BUSINESS GROSS FIXED CAPITAL FORMATION, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965.

Column (1): Data on Gross National Product in current dollars, for 1920-1925 are special estimates based on the

(2) In Firestone's table the indices refer to the "Consumer Expenditures on Goods and Services" price indices. Again note that these indices were transformed from the 1935-1939 base year to the 1949 base year by simple ratio calculations.

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working papers of O.J. Firestone, op. cit.,⁽³⁾ Data for 1926-1965 are from those issued of National Accounts already mentioned in Column (5) of Table 14.

Column (2): Data for Gross National Product in constant dollars are equivalent to those of Gross National Expenditure. These values, for the years 1920-1925, were calculated by deflating the current dollar values by adjusted indices obtained from O.J. Firestone's working papers, op. cit.; for the years 1926-1965 the data are from National Accounts issues: 1926-1956, 1959, 1963, and 1965.⁽⁴⁾

Columns (3) and (5): Data of Exports of Goods and Services and of Business Gross Fixed Capital Formation, in current dollars, for 1920-1925 are again estimates based on the working papers of O.J. Firestone. Data for 1926-1965 are from those issues of National Accounts already mentioned in Column (5) of Table 14.

Columns (4) and (6): Data for these same variables, in constant dollars, for 1920-1925 were obtained by deflating the current dollar values by the appropriate price indices as given in O.J. Firestone's working papers. The remaining
(3) Here again the 1926 values as per National Accounts and as shown in O.J. Firestone's working papers were compared. The ratio of these two values was then used to adjust the 1920-1925 quantities.

(4) It should be noted that data in constant (1949 = 100) dollars are given in Table 6 of the 1926-1956 and 1959 issues of the National Accounts, and in Table 56 of the 1963 and 1965 issues of the National Accounts.

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data were from those issues of the National Accounts already mentioned in Column (2) of this Table.

TABLE 16 - GROSS DOMESTIC PRODUCT, PERSONAL EXPENDITURE ON CONSUMER GOODS AND SERVICES, GOVERNMENT EXPENDITURE ON GOODS AND SERVICES, DOMESTIC GROSS FIXED CAPITAL FORMATION, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965.

Column (1): Data of Gross Domestic Product, in current dollars, are from sources already described in Column (3) of Table 14

Column (2): Data of Gross Domestic Product, in constant dollars for the years 1920-1925 were obtained by deflating the current dollar values by the adjusted GNE indices contained in O.J. Firestone's working papers; data for the years 1926-1965 were calculated by deflating the current dollar values by the GNE Implicit Price Indexes contained in the National Accounts of the years 1926-1956, 1959, 1963, and 1965.

Columns (3), (5) and (7): Data for Personal Expenditure on Consumer Goods and Services, Government Expenditure on Goods and Services, Domestic Gross Fixed Capital Formation, in current dollars, for 1920-1925 are from O.J. Firestone's working papers, op. cit.; data for 1926-1965 are from National Accounts issues mentioned in Column (5), Table 14.

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Columns (4), (6) and (8): Data for these same variables, in constant dollars, were obtained for the years 1920-1925 by adjusting to a 1949 base the values given in O.J. Firestone's working papers. Data for 1926-1965 were taken from issues of the National Accounts for those years given in Column (2) of Table 15.

TABLE 17 - NET NATIONAL INCOME, PERSONAL INCOME, IMPORTS OF GOODS AND SERVICES, IN CURRENT DOLLARS, CANADA, 1920-1965.

Columns (1) and (2): Data of Net National Income and Personal Income are from sources already described in Column (3) of Table 14.

Column (3): Data of Imports of Goods and Services for the years 1920-1925, are from O.J. Firestone's working papers, op. cit. Data for 1926-1965 are from National Accounts issues mentioned in Column (5) of Table 14.

TABLE 18 - GROSS DOMESTIC PRODUCT OF MANUFACTURES, TOTAL DOMESTIC EXPORTS, EXPORTS OF MANUFACTURED GOODS, AND INVESTMENT IN MANUFACTURING INDUSTRIES, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1920-1965.

Column (1): Data for Gross Domestic Product of Manufactures in current dollars, for the years 1920-1925 were calculated by multiplying the constant dollar values as given in Column (2), below by the wholesale price index

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for manufactured goods, given in p. 297 of M.C. Urquhart, ed., op. cit., Data for the years 1926-1965 are from the National Accounts, issues: 1926-1956, 1959, 1963, and 1965.

Column (2): Data for Gross Domestic Product of Manufactures, in constant dollars, for the years 1920-1962, were obtained by multiplying the value of 4070⁽⁵⁾ by the yearly value of the "Monthly Index of Manufacturing Production, 1919-62" in Index of Industrial Production (1949 = 100), March 1963, DBS, Ottawa, May, 1963, p. 27. Data for the years 1963-1965 were obtained by multiplying the same constant (i.e. 4070) by the yearly value of "Total Manufacturing" Volume Index, in the Statistical Review issues of May 1965 and May 1966.

Column (3): Data for Total Domestic Exports, in current dollars for the years 1920-1960 are from Trade of Canada, Volume I, Summary and Analytical Tables, Calendar Years, 1959-60, DBS, Ottawa, 1965, p. 28. Data for the years, 1961-1965, are from a set of sheets containing official, but unpublished, Dominion Bureau of Statistics data.

(5) The constant 4070 was obtained by taking 23.340% of 14,885. Where 14,885 is the 1949 value of Gross Domestic Product, and 23.340 is the weight assigned to the Manufacturing sector. (See for example, Indexes of Real Domestic Product by Industry of Origin, 1935-61, DBS, Ottawa, p. 67).

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Column (4): Data for Total Domestic Exports, in constant dollars, for the years 1920-1960 were obtained by deflating the values of Column (3) above, by the export price indices found in M.C. Urquhart, ed., op. cit., p. 301, (i.e. these indices were adjusted for 1949 = 100). For the years 1961-1965, the price indices used to deflate were those from the DBS unpublished data mentioned above. Also these indices had to be adjusted for 1949 = 100.

Column (5): Data for Exports of Manufactured Goods, in current dollars for the years 1920-1960, were obtained by adding together the values of exports of Partially Manufactured Goods and exports of Fully or Chiefly Manufactured Goods, given in Trade of Canada, Volume I, Summary and Analytical Tables, Calendar Years 1959-1960, p. 134. Data for the years 1961-1965 are special estimates based on data circulated by the Dominion Bureau of Statistics. These latter figures were reached by subtracting from the value of the Total of the Domestic Exports, 90 per cent of the value of Crude Materials.⁽⁶⁾

Column (6): Data for Exports of Manufactured goods, in constant dollars, for the years 1920-1965 were obtained by

(6) As described in Chapter II of this thesis, Crude Materials have replaced, in the new definition, Raw Materials. The value of the former was assumed here to be about 90% of the latter.

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deflating the values given in Column (5) above by a special price index. This price index was calculated in the following way.

For the years 1920-1960, a price index (adjusted for 1949 = 100) for exports of Agricultural and Animal Products, and of Non-Ferrous Metals and Their Products was obtained from M.C. Urquhart, ed., op. cit., p. 301. A "weight" was assigned to these two indices in such a way that the resulting index would approximate as much as possible the Crude Materials Price Index (adjusted for 1949 = 100) for the years 1946-1960, given by the unpublished DBS' data mentioned in Column (3) above. This resulting index was assumed to constitute the Raw Materials Price Index for the years 1920-1945. For the years 1946-1965, the Raw Materials Price Index was assumed to equal the Crude Materials Price Index given in the above mentioned DBS unpublished paper.

In a verbal communication, it was suggested to this author, by a Dominion Bureau of Statistics official to assign a weight of 29.80 to Crude Materials exported and a weight of 70.20 to the sum of Fabricated Materials plus End Products exported (i.e. a weight of 51.13 to Fabricated Materials and a weight of 19.07 to End Products).

Now, given: the price index for Raw Materials, the price index for Total Domestic Exports (see Column (4) above) and the weighing system, the price index for

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Manufactured Goods Exported was calculated.⁽⁷⁾ (It should be noted that the assumption was made that a weight of 29.80, i.e. about 90% of it, could approximate the weight of Raw Materials Exported).

Column (7): Data for Investment in Manufacturing Industries, in current dollars, for the years 1920-1925 and 1926-1960, are from Estimates of Fixed Capital Flows and Stocks, Manufacturing, Canada, 1926-1960, DBS, Ottawa, 1965, pp. 102-103 and 178, respectively. Data for the years 1961-1965 are from Private and Public Investment in Canada, Outlook 1961, Department of Trade and Commerce, Ottawa, 1961, and subsequent issues of years 1962, 1963, 1964, 1965, and 1966.

Column (8): Data for Investment in Manufacturing in constant dollars for the years 1920-1925, were obtained by deflating the values in current dollars given in Column (5) above, by the appropriate price index given in O.J.

Firestone, op. cit., working papers, (this index was adjusted for 1949 = 100). Data for 1926-1965 were

(7) Remembering that Manufactured Goods Exported were defined in Chapter II equal to Partially Manufactured Goods Exported plus Fully Manufactured Goods Exported and approximately equal to Fabricated Materials Exported plus End Products Exported, then a price index for Manufactured Exported is $(P_M) = \frac{100 \cdot P_T - W_{RM} \cdot P_{RM}}{W_M}$

Where W_{RM} and P_{RM} are the weight and the price index of Raw Materials, respectively; P_T is the price index of Total Domestic exports; and W_M is the weight of Manufactured Goods Exported.

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calculated by deflating the values in current dollars for both the Construction item and the Machinery and Equipment item, by the Implicit Price Indexes given in the National Accounts of the years 1926-1956, 1959, 1963 and 1965.

TABLE 19 - VALUE OF FACTORY SHIPMENTS, TOTAL IMPORTS, IMPORTS OF MANUFACTURED GOODS, CONSTRUCTION, AND MACHINERY AND EQUIPMENT IN MANUFACTURING INDUSTRIES, IN CURRENT DOLLARS, CANADA, 1920-1965.

Column (1): Data for Value of Factory Shipments for the years 1920-1959 are from General Review of the Manufacturing Industries of Canada, 1960; data for the years 1960 and 1961 are from Canada, 1964, DBS, Ottawa, 1964, p. 220; data for the years 1962 and 1963 are from the Advance Statement, Summary Statistics of Manufacturing Industries, 1963; data for the years 1964 and 1965 are from Inventories, Shipments, and Orders in Manufacturing Industries, March, 1966.

Column (2): Data on Total Imports are from the same sources as Column (3) of Table 18.

Column (3): Data on Imports of Manufactured Goods are from the same sources as Column (5) of Table 18.

Columns (4) and (5): Data for Construction in Manufacturing Industries and Machinery and Equipment in Manufacturing are from the same sources as Column (7) of Table 18.

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TABLE 20 - EXPORTS OF RAW MATERIALS IN CURRENT AND CONSTANT DOLLARS, AND EXPORTS OF PARTIALLY MANUFACTURED GOODS AND FULLY MANUFACTURED GOODS IN CURRENT DOLLARS, CANADA, 1920-1965.

Column (1): Data for Exports of Raw Materials, in current dollars for the years 1920-1960 are from Trade of Canada, Volume I, Summary and Analytical Tables, Calendar Years 1959-1960, p. 134. Data for the years 1961-1965 were calculated by taking 90% of the values of Exports of Crude Materials, given by the unpublished DBS data mentioned above.

Column (2): Data for Exports of Raw Materials in constant dollars for the years 1920-1965 were obtained by deflating the values contained in Column (1) above by the Raw Materials Exported price indices described in Column (6) of Table 18.

Column (3): Data for Exports of Partially Manufactured Goods for the years 1920-1960 are from Trade of Canada, Volume I, Summary and Analytical Tables, Calendar Years, 1959-1960, p. 134. Data for the years 1961-1965 were obtained by subtracting the sum of the values of Exports of Raw Materials plus Exports of Fully Manufactured Goods from Total Domestic Exports.

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Column (4): Data for Exports of Fully Manufactured Goods for the years 1920-1960 are from Trade of Canada, Volume I, Summary and Analytical Tables, Calendar Years 1959-1960, p. 134. Data for the years 1961-1965 were calculated in the following way: the ratios of Fully Manufactured Goods Exported to the total of Manufactured Goods Exported were found for the years 1950-1960. The average of these values was then assumed to remain constant for the following five years (i.e. 1961-1965) and to represent the percentage amount of Fully Manufactured Goods Exported out of the total amount of Manufactured Goods Exported.

TABLE 21 - EXPORTS OF CRUDE MATERIALS, FABRICATED MATERIALS, AND END PRODUCTS, IN CURRENT AND CONSTANT DOLLARS, CANADA, 1946-1965

Columns (1), (3) and (5): Data for Exports of Crude Materials, Fabricated Materials and End Products, in current dollars, for the years 1946-1965, are from the unpublished DBS data mentioned above.

Columns (2), (4) and (6): Data for Exports of Crude Materials, Fabricated Materials, and End Products, in constant dollars, for the years 1946-1965, were obtained by deflating the respective values contained in Columns (1), (3) and (5) above by the appropriate indices (adjusted for 1949 = 100) given in the DBS unpublished data.

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TABLE 22 - IMPORTS OF CRUDE MATERIALS, FABRICATED MATERIALS, AND END PRODUCTS, IN CURRENT DOLLARS, CANADA, 1946-1965.

Columns (1), (2) and (3): Data for Imports of Crude Materials, Fabricated Materials and End Products, for the years 1946-1965, are from the same source as Columns (1), (3) and (5) of Table 21.

APPENDIX III

STATISTICAL DEFINITIONS AND METHODS

Regression analysis is a technique of data analysis used to obtain the best fit of a set of observations of independent and dependent variables to an equation representing these variables. In essence, this statistical method proceeds by evaluating the constants in the analytical expression chosen to represent the data in a manner which makes the unexplained variance of the dependent variable a minimum. The equation developed in this fashion is generally of the form:

$$Y = a_0 + b_1x_1 + b_2x_2 \dots\dots + b_nx_n$$

where Y is the dependent variable; and $x_1, x_2, \dots x_n$ are the independent variables. Regression analysis can also be used to fit some types of non-linear equations.

Data for regression analysis consists of sets of observations of the dependent and independent variables. In the case of just two independent variables, there would be N sets of values of y, x_1 and x_2 , one set for each of the N observations. The final equation would be of the form:

$$Y_p = a_0 + b_1x_1 + b_2x_2$$

where Y_p = predicted Y value.

The values of a_0 , b_1 and b_2 are to be determined such that the sum of squares of the deviations of measured Y values from predicted Y values will be a minimum.

This sum of squares is:

$$\sum (Y_p - Y)^2 = \sum (a_0 + b_1x_1 + b_2x_2 - Y)^2$$

It will be a minimum when:

$$\frac{\partial}{\partial a_0} (Y_p - Y)^2 = 0$$

$$\frac{\partial}{\partial b_1} (Y_p - Y)^2 = 0$$

$$\frac{\partial}{\partial b_2} (Y_p - Y)^2 = 0$$

Carrying out the indicated differentiations the following is obtained:

$$Na_0 + b_1\sum x_1 + b_2\sum x_2 - \sum y = 0$$

$$a_0\sum x_1 + b_1\sum x_1^2 + b_2\sum x_1x_2 - \sum x_1y = 0$$

$$a_0\sum x_2 + b_1\sum x_1x_2 + b_2\sum x_2^2 - \sum x_2y = 0$$

There are now three equations with three unknowns (a_0 , b_1 and b_2) which may be solved by a number of techniques once the sums of the variables ($\sum x_1$, $\sum x_2$ and $\sum y$), the sums of squares ($\sum x_1^2$, $\sum x_2^2$ and $\sum y^2$), and the sums of cross products ($\sum x_1x_2$, $\sum x_1y$, $\sum x_2y$) have been accumulated for all N observations.

In several Tables presented in Chapter IV, statistical

tests have been set out to accompany the equations. These tests are designed to better understand and appraise the goodness with which the economic hypothesis has matched up with the quantitative observation of the economic variables.⁽¹⁾

1. t-Statistic. This statistic is formed by dividing an estimated parameter, b , by its unbiased standard deviation from sampling, $\bar{S}(b)$. The "t" values are placed in brackets underneath the numerical estimates of the parameter to which they apply.⁽²⁾ The purpose of the t-statistic and its distribution is to test the hypothesis that the parameter is not significantly different from zero. It is consequently a statistical test of the economic hypothesis that the associated variable does

(1) This section is based on T.M. Brown, Canadian Economic Growth, Queen's Printer, Ottawa, 1965, pp. 257-259.

(2) It should be noted that in some tables shown in Chapter IV, the $\bar{S}(b)$ values rather than the t values have been placed underneath the parameters. The reason for using both these statistics (i.e. $\bar{S}(b)$ and t) as well as for using both the Von Neumann ratio and the Durbin-Watson ratio, is because calculations have been made in different Computing Centres. Each Centre has supplied its own, already prepared, regression program.

Note additionally, that in order to distinguish between the $\bar{S}(b)$ values and the t values, the latter have a T in front of the brackets.

exert a significant causal influence on the variable being explained by the equation. (3)

2. The Standard Error of Estimate - \bar{S} . This statistic measures the size (dispersion) of the random component of the average value of the variable being explained, Y, say.

3. The Coefficient of Correlation - R. This statistic estimates the standard deviation of the systematic component of the variable being explained, y, to the standard deviation of Y. In this thesis, also the Coefficient of Determination, R^2 , has been used. (4)

4. Von Neumann Ratio - $\frac{\sum u_t^2}{S^2}$. This is the ratio of the mean square successive differences of errors, u_t , to

(3) In this thesis the "degrees of freedom" (i.e. number of observations less number of parameters in equation) are generally above 30. For 30 d.f., at the .05 level of significance (two-tailed test), $t = 2.04$.

If $|t| \geq 2.04$, then the hypothesis that the parameter b is not significantly different from zero is rejected. In using this rule there exists the possibility of making a Type I error, i.e. rejecting a hypothesis when it is true, 5 per cent of the time it is used.

(4) In examining the problems of regression and correlation the following distinction should be made. "Regression" involves the estimation of one variable (the dependent variable) given one or more related variables (the independent variables). "Correlation" involves the degree of relationship between variables which seeks to determine how well a linear or other equation describes or explains the relationship between variables.

the variance of the errors. This statistic tests for randomness in the time sequence of the errors, that is for lack of serial correlation or autocorrelation. The economic hypothesis is that the equation estimated with the data available, contains all of the causal variables which account for the systematic variation in Y . Hence after these variables have exerted all of their systematic influence on Y_t , what is left over, u_t , should be purely random. Should u_t , on the contrary display a systematic time pattern, rather than a random one, then the hypothesis that this equation represents the true or best explanation of Y , is rejected. It is the function of the Von Neumann ratio to test the hypothesis that u_t has a random time pattern.

The Durbin-Watson ratio which has also been used in this thesis is given by $\frac{\sum^2}{S^2} \times \frac{(n-1)}{n}$, where n is sample size. (5)

(5) The Durbin-Watson ratio can be thus transformed into the Von Neumann ratio by multiplying it by $n/n-1$. The testing of significance is as follows: for samples of size $T = 41$, for example, the hypothesis of lack of positive serial correlation (which would be the case for trends or cycles in u_t) can be accepted at the .05 significance level if $\sum^2/S^2 \geq 1.54$. This is a one-tailed test. (Values of the Von Neumann ratios can be found in Table 10 of T. Yamane, Statistics, An Introductory Analysis, Harper and Row, New York, 1964).

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