The theoretical analysis is followed by an econometric estimation of the model which determines the significance and the weights of locational factors, identified by the attraction model. In addition, the econometric analysis, by estimating the value of the attraction coefficients, permits an identification of the industries by their respective demand and supply orientation.

The "weights", or "attraction coefficients", reflect, inter alia, the degree of attraction associated with locational factors on the demand and supply sides. Attraction coefficients with high values, accordingly, indicate that the region endowed with the identified locational factors will have the greater potential in attracting industries within its political boundaries. The converse will hold for attraction coefficients with low values.

The analysis is followed by an attempt at determining the presence of locational factors in each of the Canadian provinces. The thesis concludes with an assessment of the degree of influence which each individual province has in attracting industries through a selective regional industrialization policy.

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CHAPTER I-

INTRODUCTION

1 - General Considerations

This study is concerned with a systematic analysis of locational factors at a macro level - factors that determine the existing and potential distribution of economic activities between regions of a country. However, before we embark on this analysis, it seems worthwhile introducing some general approaches as a threshold to a more ambitious discussion of industrial location policy, showing how governments at all levels can influence this process. The purpose in introducing the general analysis at this stage is two-fold: a) to highlight the role which governments can play in initiating a comprehensive development program for less developed areas, and b) to provide an analytical background for the more selective approach to be introduced in later chapters of this study.

2 - Central Industrialization Policy

The recent phenomena of regional disparities within the developed nations of the world has given rise to much interest on the part of both local and central governments in policies designed to induce rapid and equitable growth of all regions within national economies. It would seem, however, that the success of equalization policies will largely depend on the extent to which attention is paid to structural characteristics - economic as well as social - and to differences in

income and employment between different regions of a country, not merely with regard to their present levels and characteristics, but also with regard to the manner in which they are likely to evolve in the future.[1] The latter implies that industrial location policies that aim toward regional equalization should be based on both static and dynamic considerations.

A possible manner in which the integration of static and dynamic aspects of industrial policies may be attempted is to categorize regions in terms of their growth potential.[2] Accordingly, regions may be distinguished by three different types: a) prosperous regions, where the level of industrial activity and its expected growth rate are relatively high; b) potentially depressed regions, where the present level of industrial activity is high, but the expected rate of growth is relatively low; and c) depressed regions, where both the present levels and future growth of industrial activity are relatively low. This hierarchical description of regions implies that an overall industrial policy must be sufficiently flexible to take into account the differences in economic conditions and prospects which may exist between different regions of a country as well as at different points of time. For example, regions that are potentially depressed require an industrial policy which will not only prevent further disintegration but will also attract future industries to the area. Similarly, depressed regions require the prior development of an infrastructure to enable

[1] J.G. Williamson, "Regional Inequalities and the Process of National Development: A Description of the Patterns", Economic Development & Cultural Change, Vol. 13, (1965).

[2] L.H. Klaassen, Area Economic and Social Redevelopment: Guidelines for Programmes, O.E.C.D., Paris 1965, p.30.

industries to migrate and settle in the region. Nevertheless, the frequent tendency of most central governments is to lean toward policies which do not distinguish clearly between the heterogenous economic environment of different regions.[1] This attitude of central governments may be rationalized as stemming from their preoccupation with national objectives. But, quite clearly, a policy which fails to distinguish between the needs of different regions of the national economy cannot be expected to maximize its welfare in an equitable manner.

There is an additional factor which mitigates against successful efforts toward a balanced regional growth. Central governments seem unable or reluctant to choose between alternative policies directed toward migration of people from depressed regions to growth centres, and of bringing industrial activity to depressed regions.[2] Both of these alternatives and the contradictions they pose merit careful consideration in any balanced regional policy.

The historical evolution of growth and decay of industries indicates that regions may go through stages of relatively high to low growth, and often to stagnation.[3] A presently distressed region may have had a relatively high level of economic activity in the past, but the evolutionary process may have been such as to lead to a low level

1 L.H. Klaassen, Methods of Selecting Industries for Depressed Areas, O.E.C.D., Paris 1967, p.2.

2 H.W. Richardson, Regional Economics: Location Theory, Urban Structure and Regional Change, Weidenfeld and Nicolson, 1969, Chapter 15.

3 Solomon Barkin, "Principles for Area Redevelopment Legislation", Labor Law Journal, August 1959.

of present industrial activity in the region. This in itself implies that presently distressed areas can once again be revived as prosperous units of economic activity. However, although the possibility may exist, it is not likely to be induced by natural working of the market mechanism; appropriate policies directed toward the reconstruction of an antiquated infrastructure in distressed and potentially distressed areas are necessary. The latter, in turn, may lead to the creation of secondary growth centres and thus generate a cumulative process for the fulfillment of the regionally balanced growth objective.[1]

The policy question which seems to generate considerable controversy is whether the creation of secondary growth centres in depressed regions is compatible with the overall objective of continuous national growth, or whether a better alternative consists in the migration of people from distressed, or potentially distressed, regions to existing growth centres. There seem to be at least two arguments that militate against the latter alternative. The first originates from welfare considerations which suggest that social welfare is not properly reflected in national economic growth alone, and that overall growth arguments may have only a remote relevance to the depressed regions. The welfare argument underlies the fact that in democratic societies central governments have a political obligation to provide each member of the community with the basic facilities of income and consumption ideally in the area in which he lives. However, such an obligation cannot be fulfilled if governmental policies permit the draining of resources from less

[1] N.M. Hansen, "Development Pole Theory in a Regional Context", KYKLOS, XX, 1967.

developed areas to the existing growth centres by continuous migration of the area's younger and therefore more efficient labour force.[1]

The second argument rests on the evidence that the migration of people from the less developed areas to the growth centres frequently impairs the objective of national economic growth. This evidence is based on the historical evolution of existing growth centres, which shows that per capita incomes within certain limits increase continuously with increasing agglomeration.[2] However, as per capita operating costs in growing agglomerations tend to rise even faster, the increments in income are likely to decrease as agglomeration grows larger. Then, if the aggregate operating cost per capita is compared with the aggregate income per capita of the centre, agglomerations will eventually reach a size where the difference between income and costs per capita attains a maximum. This may be construed as the optimum size of the centres[3] yielding the maximum total saving for the purpose of future investment in the centre. This, in turn, is indicative of the fact that the centre has reached that level of activity which yields the highest rate of economic growth. An increase of economic activity beyond this optimum implies that total saving and hence future investment together with economic growth, will begin to decline. Continued

1 G. Myrdal, Economic Theory and Under-Developed Regions, Harper & Row, 1957, Chapters 3-5.

2 L.H. Klaassen, "Regional Policy in the Benelux Countries", in F. Meyers (ed.), Area Development Policies in Britain and the Countries of the Common Market, U.S. Department of Commerce, Washington, D.C., 1965.

3 C. Clark, "The Economic Functions of a City in Relation to its Size", Econometrica, 1945. Also, H.W. Richardson, Regional Economics, Weidenfeld & Nicolson, 1969.

increases in economic activity beyond this point eventually give rise to economic stagnation, i.e., zero or even a negative rate of economic grwoth.

In view of the above, it seems that a decentralized growth policy aimed at the creation of secondary centres is likely to be a more rational means of achieving the dual objective of regionally-balanced and national economic growth. One effective instrument to achieve decentralization is the concept of "Industrial Estate" which basically consists in rebuilding the economic infrastructure within a given region in order to promote the location and growth of directly productive industrial activity. The following quote describes the policy.

> "Industrial development policies have used industrial estates to accelerate industrialization and employment opportunities, to encourage foreign investors to locate manufacturing plants within a particular country, to foster and modernize small and medium-sized firms and to relieve hardship in depressed areas by expanding and diversifying the industrial base. Decentralization policies have used industrial estates to decentralize population from large urban centres, to provide an economic base for a new town or growing suburb of a metropolitan area, to encourage the development of rural and underdeveloped regions within a country ..."[1]

3 - Regional Industrialization Policy

Implicit in the previous analysis is the view that central governments play an important role in regional industrialization policies. However, the degree of their participation may vary from country to country, depending on the system of economic organization prevailing in the country. In most cases, at least in free enterprise economies, the central government usually plays a minimal, complementary role. This

1. The Physical Planning of Industrial Estate, United Nations, New York, 1962, p.1.

role is limited to providing the initial leadership in introducing an overall industrial programme to the regional governments which must ultimately bear the responsibility for maximizing employment and production within their political jurisdiction. This is justified on the ground that regional governments are the ones most likely to be aware of the region's particular social and economic needs, and therefore, most suitable to implement an industrial programme which will fit the unique social and economic environment of the region.[1]

The frequency of industrial estates as an instrument of regional growth in developed countries has increased substantially in the course of this century, reflecting the widespread recognition of the need for reconstructing the infrastructure as a first attempt to ward an industrialization programme.[2] Such policies underline the requirement that existing infrastructure should be improved in a way that permits the exploitation of the region's natural resources or to aid the region in producing those goods and services for which its geographic, social and economic structures are the most suited. In other words, the lay-out of an industrial estate must be unique and selective, depending on the type of industries which will locate in the region. In this context, we may quote as follows:

> "Determination of the appropriate type of enterprises is obviously called for at the time an estate for small industries is planned, if relationships of interdependence and complementarity are to be established among occupants, or between them and large industries, and if common services are to be provided by them economically and efficiently ...

1 Edgar M. Hoover, An Introduction to Regional Economics, Alfred A. Knapt, 1970; Chapter 9, p.288.

2 William Bredd, Industrial Estates - Tool for Industrialization, Glencoe, Illinois, 1960.

> Determination of the appropriate types of industries would be based on a survey of needs and potentialities in the area, and would influence the location, size (allowing for possible future expansion) and industry composition of the estate. It would affect the type and size of pre-constructed factory buildings and indicate the need for special installation, for instance, railway sidings rather than, or in addition to trucking facilities. It would also affect the type of common facilities to be established on the estate."[1]

4 - Selection of Industries

It would seem that a region should attempt to attract those industries which fulfill the following two criteria: 1) an increase in employment opportunities in the region and 2) an increase in the rate of economic growth of the region.[2] The first criterion may be termed a short-run objective in that its aim is to attract those industries which will have a direct and immediate impact on employment. This criterion may inevitably result in attracting labour-intensive industries to the region. The second criterion, fulfilled only in the long run, may, however, require the attraction of relatively capital-intensive industries. This is not to suggest that labour-intensive industries are not capable of inducing economic growth in the region. Rather, the intent is to underline the fact that such industries are capable of fulfilling the growth objective only to the extent to which employment opportunities are increased, and may not necessarily increase the growth potential. In other words, to the extent that labour-intensive industries usually produce goods and services for purposes of immediate consumption, increase in employment opportunities and economic growth which

1 Establishment of Industrial Estate in Underdeveloped Countries, United Nations, New York, 1962, p.20.

2 J.P. Hutton & K. Hartley, "A Regional Payroll Tax", Oxford Economic Papers, XX (1968), p.418.

they generate is limited to the additional increase in production of such goods and services. On the other hand, capital-intensive industries may have a minimal direct impact on employment, but because of their likely technical relationships with other industries in the area, they may have a larger long-run impact on employment than labor-intensive industries. However, because of its indirect nature, the final impact on employment may be realized only in the future through an increase in output of other firms in the region. The impact thus generated can be measured by the direct Leontief inverse of the regional input and output matrix.[1] Industries which have the greatest linkage with other existing industries in the region will generate the greatest impact on employment and, hence, on the economic growth of the region. These industries can, in turn, be identified with the Perroux-type of "propulsive industries" which generate growth points in the region.[2]

From what has been said so far, it follows that Perroux-type industries are the most capable of simultaneously achieving the dual objective of increasing employment opportunities, and of inducing continuous economic growth in the region. It is clear then that a policy of attracting the Perroux-type of industries to the region is the most appropriate one. In order to make these policies as effective as possible, an attempt should be made to compare the existing socio-economic structure of the region with the locational requirements of these industries. The remainder of this chapter is devoted to the discussion of locational factors, while in the next chapter, an attempt is made to

[1] W. Leontief, Input-Output Economics, Oxford University Press, 1966.

[2] J.R. Lasuen, "On Growth Poles", Urban Studies, Vol. 6, No. 2, June 1966.

reconcile the socio-economic structure of the region with the locational factors contributing to the growth of Perroux-type of industries.

5 - Locational Factors: The Classical Approach

The pioneering work on locational factors was initiated by Von Thunen in an attempt to determine an optimal distribution of crops on his own farm land.[1] Since then, a considerable interest has been generated, mostly among German economists, to study locational factors for industrial firms. The classical locational analysis was greatly simplified by assuming homogeneous inputs of production, and hence equal production costs everywhere in space. Thus, the only variable elements of the costs of supply were limited to the cost of transporting inputs to production location and finished products to consumption centres. The production location which minimized the sum of these transportation costs was therefore the optimal location for the firm. Although other considerations such as the proximity of a market and its influence on the size of the firm and labour costs were introduced later, all these were treated as causing greater or smaller deviations from the optimum location derived from the minimization of transportation costs alone.[2] This theory was modified by Hoover who introduced the concept of "localization economies" which result not only from large scale production but also from the presence of firms technically related to each other.[3]

1 J.H. Von-Thunen, Von-Thunen's Isolated State; translated by Carla M. Waberberg, London, Permagon Press, 1966.

2 A. Weber, Theory of the Location of Industries; translated by Carl J. Friedrich, The University of Chicago Press, 1966.

3 E.M. Hoover, Location Theory and the Shoe and Leather Industries: Harvard University Press, 1937, p.90.

Thus, the locational factors in classical analysis are associated typically with the minimization of transportation costs or, more generally, with the minimization of production costs. The latter include economies of scale as well as pecuniary and technological external economies which are believed to create least production costs sites.

Clearly, the classical approach which treats transportation costs as the primary consideration in determining an optimal location for the firm cannot be applied to those firms where transportation costs are a minor part of production costs. In these cases a more relevant theoretical starting point is required. Further, due to recent technological innovations in the transportation industry, transport costs have become a relatively minor consideration even for those firms where they originally played a basic role.[1] Currently, and probably to a greater extent in the future, industries are becoming "footloose" in the sense that location decisions are not based on regional differentials in production or distribution costs. A recent analysis states that:

> "Most metropolitan areas in the United States today offer conditions for the location of economic activity that are, to a large degree, equivalent. Except for first-stage resource users - such as lumber and mill products, certain construction materials, and petroleum refining industries - the bulk of American manufacturing is free to locate almost anywhere. Production costs, it may be estimated, probably vary by less than 10% among alternative locations, and even this small difference may be declining. The national market is becoming increasingly accessible from all potential locations and external economies can be obtained on practically the same scale in all of the larger metropolitan regions."[2]

1 M. Chisholm, "Agricultural Production, Location and Rent", Oxford Economic Papers, 1961.

2 John Friedman, "Regional Development in Post-Industrial Society: Some Policy Considerations". Nations Manpower Revolution, 1964; p.2333.

In view of the above analysis, it seems that the classical approach which treats locational factors as guided solely by production costs remains unsatisfactory, since it fails to take account simultaneously of demand considerations,[1] or of differences in revenues of the firm that may originate at different locations due to differences in the size of markets, and elasticities of demand. One may rationalize the "pure" production costs approach on the assumption that equal revenues prevail at different production locations - an assumption which is valid only within a static framework. Its validity is open to serious question within a dynamic, or even in a comparative static, framework where factors pertaining to demand or revenue, such as per-capita income and consumer taste, enter the analysis as variables and are subject to continuous change. For the static conclusion to remain valid, it is necessary that factors associated with demand change in the same proportion in each production location. But there is no rationale for assuming this type of uniform change in demand and revenue factors in diverse locations.

It seems reasonable to conclude, therefore, that the classical analysis for determining locational patterns has resulted in a dichotomy which is irrational in an economic world where both the size of the market as well as cost considerations determine the future viability of a firm, and hence its production location.[2] In any event it remains

[1] Losch, in his book titled The Economics of Location, introduced the analysis of demand, assuming production costs to remain constant through space. This, however, is equally unjustifiable, as the above case, where only production costs are considered.

[2] In this context, we are discussing the classical approach to location theory. Though recent textbooks have integrated Revenue and Costs consideration. See, H.O. Nourse, Regional Economics, McGraw-Hill, 1968.

unclear that locational factors emerging from revenue and costs considerations alone will be able to account for all location decisions. In certain cases, the life style of an area, or sentimental values associated with a certain locality, may play an important role in the entrepreneur's decision as to where to locate his production plant. However, in the final analysis, if a firm's production location was chosen on non-economic considerations, it is unlikely that it will be able to successfully compete with other existing or potential firms. It follows from this that existing firms which enjoy a viable growth must therefore have been optimally located. Hence, an approach which attemps to study the locational factors on a priori basis will help in explaining the existing distribution of industries between regions of a country. It is the objective of the next few chapters to develop such an approach.

CHAPTER II

ANALYTICAL APPROACHES TO ATTRACTING INDUSTRIES TO REGIONS

1 - Introduction

We have shown in the previous chapter that the framework within which the classical approach derives locational factors for the individual firm is essentially of a perfectly competitive nature. The simplified assumptions on which it rests enables the classical analysis to abstain both from variations in production costs, other than those arising from transportation costs, as well as from variations in demand occurring through space.

If the problem of seeking a production location is posed within a perfectly competitive world where differences in prices of finished goods and factors of production are due to variations in costs incurred in transporting goods and factors to and from production location, then, a linear programming approach which minimizes transport costs will result in a unique optimal production location to which all other sites are shown to be inferior.[1] Clearly, such micro approaches are not appropriate for our analytical framework where the main focus is on the question as to how industries are attracted by a given region, and not to derive an optimal location for the individual firm. Yet, to a limited extent, the micro approach provides an appropriate background to the more

[1] Leon N. Moses, The General Equilibrium Approach, in Spatial Economic Theory, ed, R.D. Dean et al, The Free Press, New York, 1970.

aggregative approach of interest to us. Thus, rather than being concerned with the optimal location for a single firm, we are interested in determining the optimal distribution of industries between regions of a country.

The aggregate formulation of the problem shifts the emphasis to the availability of the industry's "requirements" in given regions. This means that, on the supply side, the industry has to take account of the availability of raw materials and primary factors or production such as skilled labour, while on the demand side it has to reckon with local demand which limits the industry's sales in a given region. To some extent, one can still pose the problem of an optimal distribution of firms between regions within a perfectly competitive framework. However, it will not be very rewarding to do so since the solution will be indeterminate. For example, let us assume that a firm's or an industry's input requirements are equally available in every region of a country. It then follows that the industry will be indifferent as to the region in which it should locate. In the single-firm, classical framework, it is not unreasonable to assume an infinite availability of production requirements with respect to the firm in question. But, once the question is posed in terms of requirements for all firms, the assumption of infinite availability of production requirements is no longer rational in a world of scarce resources.

2 - The Programming Approach to Locational Factors

The standard method of solving for the spatial distribution of production activity is to minimize total transportation costs of both inputs and outputs, given regional demand and the prices of raw materials and semi-finished goods used in production. A linear programming approach

of this type in a general equilibrium setting results in a unique solution as to the level of output to be produced and interregional movement of goods. At a theoretical level, Lefeber's model provides a good example of this approach where the attempt is to determine simultaneously, within a Walrasian framework, an optimal locational pattern that maximizes the value of production of final goods for consumers.[1] However, unlike Isard who views transportation as inputs into production,[2] Lefeber views transportation as a service which is provided to the productive sector to transport factors to production locations and finished goods to market centres. This enables him to endow the transportation industry with its own production function which competes for the same factors of production as does the productive sector. It follows, then, that within a full employment framework, transportation services have an opportunity cost. To the extent that the transportation process decreases production capacity in other productive sectors, it increases both the price of finished goods and rental to productive factors, thus inducing a lower level of consumption and hence of social welfare. Obviously, in equilibrium, differential in factor rents and in prices of homogeneous commodities at different production locations and market centres respectively must equal the marginal cost of transporting the factor to production locations, and the finished product to market centres.

1 L. Lefeber, op. cit.

2 W. Isard, Location and Space-Economy, the M.I.T. Press, 1956.

A similar programming approach was followed by Thoss in an attempt to determine the regional distribution of the paper industry in Western Germany.[1] This analysis rests on the assumption that minimization of transportation costs leads to an optimal distribution of industries between regions of a country. The results thus derived are presented as the "best" distribution of the industry. However, comparing the derived optimum with the actual distribution of the paper industry, Thoss concludes that the pattern of interregional trade in Western Germany is being maintained in an irrational way.

Before accepting Thoss' conclusion, one must begin to enquire whether there are locational factors other than transportation which influence the actual distribution of industries between regions. And if so, is it rational to derive an optimal distribution of industrial activities solely on the basis of minimal transportation costs? Thoss' study and others of this kind are undoubtedly important for the particular industry under study. Their approach, however, is of a normative nature, in the sense that the researcher, on the basis of a priori reasoning, associates a limited number of locational factors with the geographical distribution of the industry. An approach which selects only a few of these elements a priori, without testing for their significance and neglecting the possibility that other locational factors may also be important seems not only unrealistic, but is almost certain to lead to false conclusions. The significance of this argument becomes clear when account is taken of the recent developments in manufacturing and service activities in whose location transportation costs play only a

[1] L.H. Klaassen, Methods of Selecting Industries for Depressed Areas, O.E.C.D., Paris 1967, pp.41-2.

minor role, while producers' personal contacts with other producers of related activities have become increasingly more important.[1]

3 - The Significance of Distance in Spatial Analysis

The above discussion suggests that the classical practice of defining the role of distance in spatial analysis in terms of transportation cost alone does not adequately reflect the true character of distance in economic relationships. For the latter purpose, one should distinguish between geographical distance and economic distance. The effect of geographical distance on two or more economic activities can adequately be weighed in terms of transportation costs incurred by the flows of commodities and services between economic activities spatially separated. The weight thus associated with transportation cost determines the role which geographical distance plays in determining spatial economic activities. The programming studies which we have previously mentioned provide a good example of this. On the other hand, economic distance reflects the more intricate relationship which producers have with other producers involved in related economic activities, as well as with consumers of their finished products.

The advantages of decreasing economic distance between producers linked with each other through forward and backward relationships can be viewed in terms of speedier deliveries of intermediate goods, prevention of delays in the production process, easier access to existing technology and so forth. In short, the close proximity of complementary

[1] L.H. Klaassen and A.C. Van Wickeren, "Interindustry Relations: an Attraction Model," in H.C. Bos (ed.), Toward Balanced International Growth, North Holland Publishing Co., 1969, pp.249-50.

producers has the advantage of easier communication with each other, which in turn contributes to a higher profit margin.[1] Similarly, advantages to producers in close proximity with consumers of their final product can be viewed as providing a better knowledge of the area, characteristics of its population, such as social attitudes, religion, taste, etc. Speedier information regarding changes in the market consequently results in faster and more efficient reaction to these changes. To measure these advantages simply in terms of costs of transporting goods from one location to another is misleading, and almost certain to underestimate the role which distance plays in spatial analysis. Aeyelts'[2] study, which compared the role of economic distance and of distance measured in terms of transportation costs in establishing the pattern of international trade between Holland and the rest of Europe, provides a good example of the argument presented. He estimated the distance elasticities[3] measured directly with trade volumes, i.e. $\frac{\partial V}{\partial D} \cdot \frac{D}{V}$; as -2, while distance elasticities measured in terms of trade volume with respect to the share of transportation cost incurred i.e. $\frac{\partial T}{\partial V} \cdot \frac{T}{V}$, was found to be -0.2. Thus, on the average, economic distance was found to be ten times as important as geographical distance.

1 This will have an impact on profit by increasing revenue and decreasing spatial costs.

2 G.J. Ayelts, DE GEVOLGEN VAN DE REALISATIE VAN de EUROMARKT VOOR de intra-Europese Handel, Economic Institute at Rotterdam, 1960, in L.H. Klaassen, op. cit., p.43-4.

3 The terms used to derive the distance elasticities are defined as follows:

V = Trade Volumes between any two countries
D = Distance between any two countries
T = Share of transportation costs

These findings are admittedly more relevant within an international trade context than within a regional framework, due to the fact that acute differences, both social and economic, are more likely to occur between countries than between regions. Nevertheless, the distinction between economic and geographical distance is equally relevant to interregional trade and consequently to the regional distribution of industries, even though of lesser significance than in international trade.

The role which geographical distance plays between economic activities spatially separated is clear and can be measured directly in terms of transportation costs. However, as shown by the previous argument, this is an inadequate measure of the complex role played by distance in economic activities spatially separated. For this task we have introduced the term "communication" which is assumed to reflect rather more fully the intricate relationship between producers of related activities and consumers of their finished product. The term "communication" and the costs associated with it are meant to reflect all possible economic costs occurring in the process of production through space- including losses of potential earnings - that result from the non-proximity of needed raw materials, semi-products, employees, and customers. It is further hypothesized that producers behave as to minimize communication costs by locating in close proximity to producers of related economic activities and/or to consumers of their final product.[1] Failure to behave in the hypothesized manner will lead to economic inefficiency, and thus to a decrease in their profit margin.

[1] A. Van-Wickeren, "An Attraction Analysis for the Asturian Economy" Regional and Urban Economics, Vol. 2, No. 3, February 1972.

However, since communication costs, unlike transportation costs, are not directly observable, an indirect approach must be developed for their measurement. This task will be postponed until the next chapter. At this stage, it seems more useful to introduce various approaches to industrialization being used in different countries. This type of analysis will in turn lead to the structural approach to industrialization which is of interest to us.

4 - Approaches to Industrialization

The underlying theme of this study has been that a region embarking on an active industrialization policy should limit itself to attracting those industries for which its economic structure is most suited for their viable growth. To accomplish this task the region should examine its existing economic structure in terms of both supplies of inputs to and potential buyers of products from industries to be attracted. It should then compare its structure with the structures in other regions to determine whether the region in question has a comparative advantage for the industries sought vis-à-vis other regions which compete to attract the same industries.

A somewhat different approach requires the region to undertake studies of locational requirements for a number of industries, and then compare these requirements with its own structure; modify the structure wherever possible and necessary, and proceed to attract those industries which seem most appropriate for the existing or modified structure. However, since this approach requires that each region undertake the same task, it will inevitably involve duplication of effort. Thus, for individual regions to undertake these studies in isolation would seem to be inefficient. A more efficient procedure toward

a study of locational factors for all industries is that central governments should undertake the task. Each region can, then, compare its own economic structure with the locational requirements for various industries, and proceed to attract those which the region deems to be most suitable.

The type of studies mentioned in the previous paragraph will be examined in greater detail in the chapters to follow. At this point the question may be raised as to whether a region can make use of regional breakdowns of national forecasts to project its own rate of growth. An example of this is the balanced regional model introduced by Isard.[1] Basically, the model employs a national input-output framework from which, given a vector of final demand, national output is determined for each sector. Subsequently, the national output is allocated to each region on the basis of regional coefficients derived either from a regional distribution of production or from locational studies. On the basis of the national coefficients of production, the input requirements for each region are derived, and the final regional demand which would maintain the level of the allocated regional output is determined. Changes in the final regional demand will induce changes in regional output in a cumulative manner denoted by a regional output multiplier. Thus, on the basis of this model, regional growth is determined on the basis of changes in regional demand.

A serious objection to the regional balance model, as well as to similar input-output models, as a means of forecasting regional growth is that it treats as given the prevailing economic structure

[1] W. Isard, Methods of Regional Analysis: An Introduction to Regional Science; John Wiley & Sons; New York - London, 1960, pp.346-48.

and assumes that regional growth will take place in the same manner as it has in the past. However, the basic postulate of the present study has been that depressed or developing regions can undertake appropriate industrialization policies in order to attract new industries which will induce a higher rate of economic growth than in the past. If one accepts this type of a dynamic framework, it is not very meaningful to derive regional, or for that matter national, growth rates on the basis of input-output models which assume fixed coefficients of production, and in the case of the regional balance model, fixed regional coefficients implying that regional production patterns will not change. In a dynamic context, regional production patterns do change. However, regional forecasting on the basis of fixed coefficient models will allocate lesser growth to those regions whose policy is to attract new industries. In what follows, we will outline some of the methods being used to fulfill the latter objective.

4.1 - The Check-List Approach

The check-list approach is essentially an attempt to provide entrepreneurs seeking a production location with information about facilities in different regions, such as prices of utilities, labour, raw materials, etc. It is hoped that this type of information will aid the entrepreneur in finding an optimal production location, leading in turn to an optimal distribution of industries between regions.

Although the check-lists provide useful information to the entrepreneur, they should not be used as the sole instrument of industrialization policy. Firstly, they do not provide information regarding such crucial variables as exports and imports of the region, and regional

consumption of products. Secondly, it is basically a passive method, in the sense that once this general and limited information is made available, the government simply sits back and waits for industries to come. This passivity is largely related to the type of information which is contained in the check-list approach. With more detailed studies, information as to the type of industries to be attracted to the region could emerge and prompt the local governments to take the initiative in contacting these industries. It is important to recognize that the basis for an industrialization policy should be that the region "must learn to view the creation, operation, and expansion of job-generating business firms as something which can be accomplished by its own initiative, imagination, and energy."[1] The mere publication of a catalogue with essential but not sufficient information about industries' requirements is only a first step toward a more ambitious approach to an industrialization policy.

4.2 - The Expert Visit Approach

Another method toward a regional industrialization policy is "the expert visit approach" which has often been used in the United States. The results of such visits are available in a series of documents. The principle of the method is basically very simple. A group of outside experts on regional economics and related fields is invited to meet with local experts and representatives of the local government. In principle, the outside expert should have the broad knowledge of

1 The Community and ... Economic Development, U.S. Department of Commerce & Area Redevelopment Administration, Washington, May 1964, p.10.

the requirements necessary to carry out an effective regional industrialization policy. In addition, he should have the experience in applying this knowledge to specific regions. Similarly, the local expert should have an understanding of the region's economic needs, economic structure, and attitudes of the people.[1] Often, the combination of these two sets of knowledge results in useful proposals which if developed further could be of great value to the region.

Unfortunately, despite the fact that the approach is quite sound, the way in which it is presently practised is inefficient. In many cases, the outside experts meet with the local authorities only once or infrequently, and on the basis of this meeting the outside experts are expected to recommend effective means of industrialization. While, a more efficient procedure, though more costly, would be for the outside experts to meet with local authorities on a continuous basis so as to criticize work done, give new suggestions, and stimulate further research. The benefits of this procedure may be sufficient to more than offset the additional costs involved. Also, in only a few cases, a thorough and systematic study of the region prior to the experts' visit has been made, and its content made available to the outside experts. These practices result only in vague and general recommendations and are of little value to the region. Moreover, the time and resources required to evaluate the proposed recommendations could certainly be used to prepare a more systematic approach to a regional industrialization policy.

[1] L.H. Klaassen, Area Economic and Social Redevelopment, O.E.C.D., Paris 1965, pp.93-5.

4.3 - The Local Forecast Approach

The local forecast approach appears in a number of economic studies which are intended to be the basis for future industrialization policy.[1] The main advantage of this approach is its simplicity. It basically uses past trends of industrial activity such as demand elasticities, labour productivity and current expansion plans for local industries to forecast future economic growth. The rationale is that if existing industries enjoy a viable growth it must be because the region provides adequate requirements for these industries. Thus, other firms having similar requirements, i.e. firms within the same industries, may also be persuaded to locate within the region. In other words, the selection of new firms to be attracted is made solely on the basis of the most expanding industries of the region.

The main disadvantage of this approach is that it implicitly assumes the existing economic structure to be adequate to accommodate additional firms which may be attracted by the region. Although this may very well be the case, it nevertheless should emerge only as a result of extensive studies of the area's economic structure. Also, since future economic growth of the region is extrapolated from past trends of economic activity, the approach is unable to reveal potentialities for new economic activities for which the region may be endowed. This argument is of importance when viewed in the context of depressed regions whose economic viability and hence future existence depends largely on their ability to attract new industries. The point, therefore, is that the region's potentialities for new industrial

[1] J.C. Burrows et al., Industrial Locations in the United States, D.C. Heath & Company, 1971.

activity cannot be revealed entirely on the basis of historical studies.

A method similar to the forecast approach is the type of survey introduced by the U.N.[1], prior to the preparation of a master-plan, for use as a first step in industrialization policy. The advantage of survey studies over the forecast approach is basically that the former does not implicitly assume an adequate existing industrial structure for the attraction of new industries. The features normally emphasized in the survey studies are the following:

> "1. A review of the economic and industrial structure of the area to determine its strength and weaknesses. This would include an examination of the size, location and type of all industrial undertakings already in operation within the area as a whole, an appraisal of their general potential, their present and future needs and their linkages with other undertakings.
>
> 2. An occupational and industrial analysis of the working population, with special reference to unemployment trends and to skill available.
>
> 3. A demographic analysis of the population within the area, to test what the future size of the local labour force is likely to be and how this compares with local employment trends and opportunities.
>
> 4. An examination of the transport network, with particular reference to industrial traffic and journey to work.
>
> 5. A review of public utility services, with special reference to their capacity to cater for industrial users.
>
> 6. A field survey of land availability to determine the location, extent and physical characteristics of all areas physically capable of industrial development, bearing in ming general planning policy and the needs of other types of use for both new development and redevelopment."[2]

[1] The Physical Planning of Industrial Estates, United Nations, New York, 1962.

[2] Ibid., p.15.

Although the area or the survey studies provide better information than the local forecast approach in the sense that interrelation of industries as well as the area's industrial structure are explicitly taken into account; nevertheless, whatever its value may be for the surveyed region, it is still not sufficiently flexible to consider the future economic possibilities for the region to exploit new potentials.

4.4 - The Comparative Cost Approach

The comparative cost approach[1] assumes requirements of industries such as number of workers, raw materials, intermediate goods and market size to be available, though in different amounts, in all the regions. The optimal location for a given industry is then determined on the basis of comparing production and transportation costs between regions. The region with the lowest production and transportation costs will, thus, have a comparative cost advantage vis-à-vis other regions. An optimal distribution of industries between regions, as well as the industries that can successfully be attracted by different regions, can thus be determined by carrying out these types of studies for all industries in all regions.

Regional comparative costs advantages for a given industry usually originate from innovations introduced in the production of a raw material or an intermediate good in one region. For instance, the completion of a new system of transport network, both internal and external, will affect the relative advantage of the region in attracting new

[1] W. Isard, Methods of Regional Analysis: An Introduction to Regional Science, M.I.T. Press, 1960, p.233.

industries.[1] The advantage, however, is restricted to heavy industries which use large transport outlay. Such industries include iron, steel and aluminum. It is somewhat dubious as to whether the analysis can be generalized to include light industries which use fewer transport outlay.

There appear to be two distinct disadvantages in using comparative cost studies for determining an optimal distribution of industries between regions. The first may be stated as follows. Assume that, on the basis of the method described in the previous paragraphs, an optimal location for a given industry is determined. One cannot claim, however, that the same conditions would be valid for new industries locating in the region, since the new firms or industries are now faced with new economic conditions brought about by the location of the original industry to the region. Therefore, what may have been the optimum for the original industry is not necessarily the optimum for additional firms locating in the region. Secondly, for a specific region, the approach assumes both the cost-price structure and the magnitude of the market as constants. This assumption may be tenable where the industry is small. This is not so, however, for a large industry which will most certainly have an impact on the parameters assumed as constant. Thus, an industry may originally find it advantageous to locate in the region from a comparative cost standpoint. However, once it locates there the comparative cost advantage may no longer exist.[2]

1 Ibid., p.234.

2 Ibid., p.234.

The arguments which we have introduced against the comparative cost advantage are in fact similar to the ones raised earlier in this chapter with respect to the micro and the macro approaches purporting to explain an optimal distribution of industries between regions on the basis of constant parameters and minimal transport cost considerations.

4.5 - The Perloff-Access Approach

A more relevant starting point for the attraction of industries is the "access approach" introduced by Perloff.[1] He shows, using a chart containing 16 hypothetical regions, how each region is likely to grow on the basis of its access to both product and factor markets. Because of its importance to our own analysis we reproduce the chart on the next page.

1. Harvey S. Perloff with Vera W. Doods, How a Region Grows, Area Development in the U.S. Economy, Supplementary Paper No. 17, published by the Committee for Economic Development, New York, March 1963.

TABLE I

A SCHEMATIC PRESENTATION OF TYPES OF REGIONS THAT CAN EXHIBIT DIFFERENT GROWTH POTENTIALS

		GOOD ACCESS TO BASIC INPUTS[1] FROM EXTERNAL REGIONAL AND NATIONAL SOURCES		POOR ACCESS TO BASIC INPUTS[1] FROM EXTERNAL REGIONAL AND NATIONAL SOURCES	
		GOOD ACCESS TO BASIC INPUTS IN HOME REGION	POOR ACCESS TO BASIC INPUTS IN HOME REGION	GOOD ACCESS TO BASIC INPUTS IN HOME REGION	POOR ACCESS TO BASIC INPUTS IN HOME REGION
Poor access to external regional and national markets	Poor access to markets in home region.....	1 II	2 I	3 I	4 0
	Good access to markets in home region.....	5 III	6 II	7 II	8 I
Good access to external regional and national markets	Poor access to markets in home region.....	9 III	10 II	11 II	12 I
	Good access to markets in home region.....	13 IV	14 III	15 III	16 II

[1] Not only basic resources but important intermediate sources need to be considered.

NOTE. Roman numerals indicate number of "good" access dimensions and suggest relative overall locational advantages or disadvantages.

The basic feature of Table I is that each region is divided in the form of an input-output access either to home region or to the country, or both. In addition, the author assumes that this general characteristic (the region's access to both product and factor markets) will determine the growth potential of each region. For example, region 4 with poor access to both product and input markets will have little prospect for growth. On the other hand, for region 13 with good access to both markets, the opposite is true, i.e. it will have unsurpassable growth potentials. Other regions such as 1, 2, 3, 8, 12 and 16 are only slightly better off than region 4, in the sense that their good access to one of the markets is offset by lack of access to the other. Regions 6, 7, 10 and 11 are considered relatively better off in the sence that they, at least, have some access to both markets. Regions 5, 9, 14 and 15 are still better off in the sense that they enjoy advantages either in home markets or good access to national markets.[1]

The basic advantage of the Perloff-access approach over those previously discussed is that it considers the region's growth potential within the framework of its economic structure. As such, the approach remains useful in evaluating the region's general economic situation, especially with respect to its access to regional and national markets. However, for our purpose which is basically to evaluate the region's success in attracting industries, the approach must be modified to include each industry's input-output access. In this way, information about each industry's factor and product markets, as well as its size and origin will be revealed. We can then proceed to attach weights to

[1] Ibid., p.32.

requirement and sales flows for each industry in order to evaluate the region's location advantages and disadvantages, and thereby determine which industries will be suitable and which unsuitable for the region. We provide an example below which illustrates the argument presented.

We assume a hypothetical country with three regions. Our objective is to analyze the economic structure of the regions relevant to the ith industry. The structure relevant to industry i is, firstly, the regional distribution of its input requirements, and secondly, the regional distribution of its demand for intermediate and final consumption. We will assume that the regional distribution of these two requirements for the ith industry is as shown in Table II below.

TABLE II

Regional Structure Relevant to Industry i

Regional Distribution of Industry i's Input Requirements					Regional Distribution of Industry i's Intermediate and Final Demand				
No. of Inputs	Reg.I	Reg.II	Reg.III	Total	Industries	Reg.I	Reg.II	Reg.III	Total
1	20	80	60	160	1	10	40	10	60
2	10	120	50	180	2	20	100	20	140
3	30	180	60	270	3	40	200	40	280
					Final Demand	1000	3000	50	1350
Total	60	380	170	610	Total	1070	640	120	1,830

The first set of requirements for industry i, i.e. the input requirements, shown in the left side of Table II, indicates that approximately 62% of industry i's requirements is located in region II, and only 10% in region I. On the other hand, the regional distribution of intermediate and final demand of industry i's product, shown on the right of Table II, indicates that 58% of total demand originates in region I, 35% in region II, and 7% in region III.

Region I seems therefore to have an advantage over the other two regions for industry i's finished product, while region II has an advantage over the other regions for the industry i's input requirements. It is therefore likely that industry i will locate either in region I or region II, depending on the weight which industry i will associate with its input requirements and its total demand. For example, if industry i attaches a relatively larger weight in locating near its input source, region II will be preferred. However, if the opposite is true, location will shift to region I. However, the point is that unless we can determine the weight which each industry attaches to its two sets of requirements, i.e. input and demand, we cannot determine the industry's ex ante production location. A simple method of weighing industry's inputs and demand requirements is to use transportation costs per unit of value of inputs and/or output, which in effect implies that the distribution of industries between regions is being determined on the basis of minimizing production and transportation costs. However, as we previously discussed, the true distance variable in spatial analysis cannot be expressed on the basis of transportation costs alone. Hence, we will engage in devising an indirect approach in the next chapter, which will reflect more fully the role of spatial separation.

CHAPTER III

THE ATTRACTION METHOD OF WEIGHTED INTER-INDUSTRY RELATIONS

1 - Introduction

In chapter two we introduced two concepts of distance - physical distance and economic distance. Physical distance enters spacial analysis in terms of unit cost of transporting inputs to production locations and outputs to consumption centres. By contrast, economic distance in spatial analysis reflects a weighted[1] aggregate of communication costs in spatially diverse production, that arise between producers linked forward and/or backward with each other as well as with final consumers. The latter concept of distance which attempts to integrate into economic analysis the role of personal contacts in spatial production was judged to be the only significant one in determining spatial patterns. The purpose of this chapter is to incorporate communication costs into a formal model of spatial production.

By way of introduction, it should be noted that economic advantages arising from personal contacts tend to increase with the complexity and non-homogeneity of the products produced and traded. Conversely, if the product in question is simple and homogeneous in structure, such as iron ore and timber, communication costs will generally coincide with transportation costs.[2] In such cases, transportation costs alone will

[1] "Weighting" is intended to be a measure of the factors that influence communication costs. They are estimated in later chapters by regression analysis.

[2] L.H. Klaassen and A.C. Van Wickeren, "Inter-Industry Relations: An Attraction Model", in H.C. Bos (ed.), Towards Balanced International Growth, North Holland Publishing Co., 1969, pp.249-50.

exert the decisive influence as to where production should take place. It is for this reason that locational studies that attempt to determine the optimal regional distribution of individual industries are largely confined to such industries as oil refineries, steel plants and paper and pulp factories.[1] However, studies based on transport costs alone are not adequate to explain the regional distribution of other industries such as tool-making industries, perfume factories and services such as banking. Industrial production in Western countries has rapidly shifted to the production of complex durables and engineering products, while service industries have become increasingly more important in total production. These activities do not fulfill the conditions necessary to justify pure transport cost studies. Consequently, there has appeared a greater need to determine the role of communication costs in spatial production patterns.[2]

Accordingly, a more relevant approach, both for explaining the regional distribution of industries and for predicting which industries are likely to be suitable for given regions, consists in determining the importance of communication between industrial activities, and its influence on the spatial distribution of production. However, since the weight associated with communication between various sectors cannot be measured directly, it is necessary to rely on an indirect method for evaluating the role which economic distance or communication cost plays in spatial analysis.[3]

1 G. Torqvist, "Contact Systems & Regional Development", Lund Studies in Geography, Series B, No.35, 1970.

2 A. Gilbert, "Industrial Location Theory", in B.S. Hoyle (ed.), Spatial Aspects of Development, John Wiley & Sons, 1974, Chapter 14, pp.281-82.

3 The indirect method which we are about to introduce originated with L.H. Klaassen, in Methods of Selecting Industries for Depressed Areas, O.E.C.D., Paris, 1967.

2 - Basic Principles of the Method

We have argued earlier that growth of an industry is largely conditioned by the availability of its "requirements", i.e. total demand for the industry's finished product and total supply of the industry's inputs in the region where it is located. If, for example, there exists an infinite regional excess demand and an infinite excess supply of inputs to the industry within the region, then the industry in question is capable of unlimited growth. However, such ideal conditions seldom occur. In fact, in a number of cases the finished product of a given industry is not entirely absorbed by regional demand - a condition which would lead either to exports or to contraction of the industry's output. Similar considerations apply for the supply of input requirements to the industry. They must be imported from other regions or else output is constrained by the level of inputs supplied by the region.

It follows then that the growth of individual industries is limited either by total demand and/or supplies of inputs available in the region, or by their access to sources of demand and supply outside the region, i.e. by the ability to export its product and to import its inputs. In some cases, this ability is greatly impaired by high communication costs (including transportation costs) incurred in exporting or importing the finished product and the input requirements respectively. For example, commu cation costs associated with export of service activities such as police or fire protection may be so high that their exports to other regions may become altogether infeasible. In these cases, the level of activity is completely determined by the size of local demand for such services. Such industries, therefore, tend to be

completely demand- or market-oriented.[1] Similarly, industries may be input- or supply-oriented, in the sense that communication costs associated with imports of their inputs from other regions may increase in a prohibitive manner. Examples of such industries include food processing where the level of output is almost completely dependent on local supplies of agricultural products. On the other hand, there may exist industries whose regional supply of inputs and the existence of regional demand are equally weighted. If so, the industry may be said to be in balance.[2] In practice, very few industries are in balance in this sense; most are compelled to accord priority either to demand for their product or to supply of their inputs.

The above discussion leads to the conclusion that industries which are completely demand-oriented will not ordinarily export their finished product to other regions. The opposite is true with input-oriented industries; their output is either partly, or wholly consumed in locations other than that where production takes place.

In the context of this study, a demand-oriented activity will be identified by a close correspondence between the regional distribution of demand and the regional distribution of production. Alternatively, for input-oriented industries a close correspondence between the regional distribution of inputs and the regional distribution of production will be taken as an indication of their input orientation.

1 H.W. Richardson, Regional Economics: Location Theory, Urban Structure and Regional Change, Weidenfeld & Nicolson, 1969, p.43.

2 Jan Serck-Hanssen, Optimal Patterns of Location, North Holland Publishing Co., 1970, p.187.

3 - The Mathematical Model

The mathematical model which follows is based on the assumption that communication costs originate from inter-regional movement of goods and services. In other words, we assume "punctiform" regions where the spatial element becomes relevant only if inter-regional movement takes place. The rationale for this assumption stems from the basic concern of our inquiry with optimal inter-regional allocation of resources. Although the question of intra-regional allocation is a legitimate area of research, it lies outside of our framework. As such, communication costs are assumed to arise only from exports and imports of final and intermediate goods from and into a given region.

We define exports of final goods for each region as:[1]

$$X_i^J = (S_i^J - D_i^J) \qquad (1)$$

where: S_i^J = exports of the ith industry from region J

S_i^J = output of industry i in region J

D_i^J = total demand (intermediate and final demand) for product i in region J

It should be clear that equation (1) can also be taken as a definition of region J's imports of the final good i. For a negative X_i^J will correspond to the amount of region J's import of the ith good.

[1] In this formulation, the destination of exports of region J to any other region k is immaterial.

Thus, in effect, equation (1) with respect to its sign denotes both the export or import of region J for the ith final good. Whether it refers to a net export or net import will uniquely depend on the respective levels of S_i^J and D_i^J. The equality of S_1^J and D_i^J will indicate that the industry's output level is geared to satisfy regional demand. This definition corresponds to the concept of a market- or demand-oriented industry, as described above, implying that such an industry is neither export or import-oriented. Similarly, the inequality of S_i^J and D_i^J may be taken to imply that the industry has some input orientation which appears to be a necessary condition for the existence of interregional trade in final products.

We define imports of intermediate goods of the ith industry in region J as follows:

$$\sum_{\ell=1}^{n} M_{\ell i}^J = \sum_{\ell=1}^{n} [\beta_{\ell i} S_i^J - (\alpha_{i\ell} S_\ell^J)] \qquad (2)$$

where $\sum_{\ell=1}^{n} M_{\ell i}^J$ = total import of the intermediate good ℓ of industry i in region J

$\beta_{\ell i}$ = the amount of ℓ required to produce one unit of the finished product i. Thus, the $\beta_{\ell i}$'s are similar to the Leontief direct input coefficients[1]

$\sum_{\ell=1}^{n} \beta_{\ell i} S_i^J$ = the total requirements of the intermediate goods to produce the level of output S_i^J

$\alpha_{i\ell}$ = the proportion of gross production of industry ℓ sold to industry i

[1] W.W. Leontief, The Structure of the American Economy, 1919-1939, Oxford University Press, 1951.

$\sum_{\ell=1}^{n} (\alpha_{i\ell} S_\ell^J)$ = the total requirements of ℓ used by industry i which is available in region J.

The coefficients $\beta_{\ell i}$ and $\alpha_{i\ell}$, in equation (2), are defined from production of industry i and industry ℓ occurring at the national level as $S_{\ell i}/S_i$ and $S_{\ell i}/S_\ell$ respectively.[1] The coefficients, defined in this way, reflect an ex-post equilibrium situation existing at the national level between industry i and industry ℓ, that is, industry i's demand of intermediate good ℓ ($\beta_{\ell i} S_i$) equals the supply, or the sales of industry ℓ to industry i ($\alpha_{i\ell} S_\ell$). Hence,

$$\beta_{\ell i} S_i = \alpha_{i\ell} S_\ell$$

or

$$S_i = \frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell$$

Thus, industry i (S_i) is related to industry ℓ (S_ℓ) by the ratio $\alpha_{i\ell}/\beta_{\ell i}$ which also defines the size of industry i relative to industry ℓ (S_i/S_ℓ). Applying the coefficients $\beta_{\ell i}$ and $\alpha_{i\ell}$ at the regional level, in the manner shown by equation (2), will necessarily give rise to an interregional movement of industry i's intermediate good ℓ only, and only when the relative size of the corresponding industries at the regional level S_i^J/S_ℓ^J differs from S_i/S_ℓ. In other words, industry i will import intermediate goods only when the regional coefficients $\alpha_{i\ell}^J$ and $\beta_{\ell i}^J$ differ from those described at the national level.

As in equation (1), a negative value of $M_{\ell i}^J$ will correspond to the level of exports of the intermediate good ℓ from region J, while a positive value of $M_{\ell i}^J$ indicates the import of input ℓ for industry i in

[1] S_i and S_ℓ represents gross output of industry i and industry ℓ respectively. $S_{\ell i}$ denotes the amount of ℓ used in the production of S_i.

region J. Accordingly, the level of $M^J_{\ell i}$, irrespective of its sign, indicates inter alia the extent to which inter-regional production patterns of the ith industry differ from those of its supplying industry's. For example, a low level of $M^J_{\ell i}$ indicates a close correspondence between industry i's inter-regional production patterns with the ℓth supplying industry's. Alternatively, a high level of $M^J_{\ell i}$ indicates relatively large differences between industry i's and industry ℓ's inter-regional production patterns. The former situation corresponds to our previous definition of a complete input or supply orientation, while the latter may be identified with a demand-oriented industry.

Cases involving either complete demand or complete input orientation reflect situations where communication costs (including transportation costs) per unit of import of inputs or per unit of export of output increase in a prohibitive manner. This makes it economically infeasible for such industries to expand output to a level which would require an import of inputs, to supplement those supplied locally, or to export a portion of its output. Hence, industries which show an extreme orientation, either of the market or of the input type, must limit their output levels to regional demand, or to regionally available inputs, respectively. On the other hand, industries which do not show a complete orientation can increase output beyond levels which are not supported regionally. In other words, they can import or export their inputs and outputs respectively; nevertheless, they can do so only by increasing communication costs. The rate at which communication costs will increase will vary proportionately with the degree of the industry's orientation. The more the industry is market- or input-oriented the higher is its communication costs incurred in exporting and importing.

Thus, in view of the fact that the industry's communication costs originate from interregional trade of final and intermediate goods, we can conceptualize communication costs as a function of the industry's regional exports and imports, as shown below.

$$T_i^J = F(X_i^J, M_{\ell i}^J) \qquad (3)$$

where T_i^J = the communication cost (including transportation costs) for the ith producer in region J, and other variables have their meaning as before.

It is clear from equation (3) that communication costs will be uniquely determined by levels of exports and imports of the ith final good and the ℓth intermediate good from and to region J respectively.[1]

The producers that are randomly distributed in any given space are assumed to behave so as to minimize total communication costs. We therefore minimize T_i^J by using the Lagrangian technique:

$$\text{Min } T_i^J = F(X_i^J, M_{\ell i}^J) \qquad (4)$$

subject to the constraint that $S_{\kappa i} = \beta_{\kappa i} X_i^J + \Sigma(\beta_{\kappa \ell} M_{\ell i}^J)$ (5)

where (5) represents the level of communication devoted to industry i. Therefore $S_{\kappa i}^J$ = total communication κ used by the ith producer in region J;

$\beta_{\kappa i}$ = the amount of κ used in exporting one unit of the ith product from region J;

$\beta_{\kappa \ell}$ = the amount of κ used to import one unit of ℓ from outside region J by the ith producer.

[1] It is assumed that T_i^J increases at a decreasing rate with additional units of X_i^J and $M_{\ell i}^J$; that is,

$\partial T_i^J / \partial X_i^J > 0$; and $\partial^2 T_i^J / \partial^2 X_i^J < 0$

Similarly: $\partial T_i^J / \partial M_{\ell i}^J > 0$; and $\partial^2 T_i^J / \partial^2 M_{\ell i}^J < 0$

The objective function T_i^J can be written as:

$$L = F(X_i^J, M_{\ell i}^J) - \mu[S_{\kappa i}^J - \beta_{\kappa i} X_i^J - \Sigma(\beta_{\kappa \ell} M_{\ell i}^J)] \quad (6)$$

Taking partial derivatives of L with respect to the exogeneous variables X_i^J, $M^J{}_i$ and μ we derive the first-order condition of optimality as follows:[1]

$$\partial L/\partial X_i^J = \partial F/\partial X_i^J - \mu\beta_{\kappa i} \quad (7)$$

$$\partial L/\partial M_{\ell i}^J = \partial F/\partial M_{\ell i}^J - \mu\beta_{\kappa \ell} \quad (8)$$

$$\partial L/\partial \mu = S_{\kappa i}^J - \beta_{\kappa i} X_i^J - \Sigma(\beta_{\kappa \ell} M_{\ell i}^J) \quad (9)$$

Dividing equation (7) by equation (8) yields the optimal condition as:

$$\partial F/\partial X_i^J \;/\; \partial F/\partial M_{\ell i}^J = \frac{\beta_{\kappa i}}{\beta_{\kappa \ell}}$$

where $\partial F/\partial X_i^J$ indicates the marginal increase in communication costs in exporting i from region J;

and $\partial F/\partial M_{\ell i}^J$ indicates the marginal increase in communication cost from importing intermediate product ℓ.

Assuming a competitive economy,

$\partial F/\partial X_i^J$ = marginal cost (MC) of communication associated with X_i^J, which, in view of our assumption, also equals t_d, the price of communication associated with one unit of X_i.

Similarly,

$\partial F/\partial M_{\ell i}^J = t_\ell$, the price of communication associated with importing one unit of intermediate good ℓ ($M_{\ell i}$).

Under optimal conditions, a firm will adjust its location-production decision such that:

$$\frac{t_d}{t_\ell} = \frac{\beta_{\kappa i}}{\beta_{\kappa \ell}} \quad (10)$$

[1] It should be observed that the 2nd order condition of optimality is automatically fulfilled as long as it is assumed that the communication cost function is concave.

indicating that the communication cost ratio must equal the ratio of physical requirements of κ per unit of export and import of the ith and ℓth good respectively.

By including the optimum prices, t_d and t_ℓ, in the communication costs function, identified by (3), we determine the communication costs for the ith producer in region J which prevails at the optimum.

$$T_i^J = t_d X_i^J + \Sigma t_\ell M_{\ell i}^J \qquad (11)$$

where T_i^J indicates the communication costs for the ith producer in region J.

Replacing X_i^J and $M_{\ell i}^J$ in equation (11) with their algebraic definition from equations (1) and (2) respectively, we obtain:

$$T_i^J = t_d(S_i^J - D_i^J) + \Sigma t_\ell [\beta_{\ell i} S_i^J - (\alpha_{i\ell} S_\ell^J)] \qquad (12)$$

By letting $T_i^J = (\alpha_{i\kappa} S_\kappa^J) P_\kappa$

where $\alpha_{i\kappa} S_\kappa^J$ is defined as the flow of communication κ used by the ith producer, and P_κ is defined as the price per unit of communication.

Assuming that $P_\kappa = 1$

Then $T_i^J = \alpha_{i\kappa} S_\kappa^J$

Substituting T_i^J for $\alpha_{i\kappa} S_\kappa^J$, equation (12) can be expressed as:

$$\alpha_{i\kappa} S_\kappa^J = t_d S_i^J - t_d D_i^J + \Sigma t_\ell \beta_{\ell i} S_i^J - \Sigma t_\ell (\alpha_{i\ell} S_\ell^J)$$

$$= S_i^J (t_d + \Sigma t_\ell \beta_{\ell i}) - t_d D_i^J - \Sigma t_\ell (\alpha_{i\ell} S_\ell^J)$$

$$\text{or} \quad S_i^J = \frac{t_d}{t_d + \Sigma t_\ell \beta_{\ell i}} D_i^J + \frac{\Sigma (t_\ell \alpha_{i\ell})}{t_d + \Sigma t_\ell \beta_{\ell i}} S_\ell^J + \frac{\alpha_{i\kappa}}{t_d + \Sigma t_\ell \beta_{\ell i}} S_\kappa^J \qquad (13)$$

Multiplying equation (13) by $\beta_{\ell i}/\beta_{\ell i}$ and $\beta_{\kappa i}/\beta_{\kappa i}$ we obtain:

$$S_i^J = \frac{t_d}{t_d+\Sigma(t_\ell\beta_{\ell i})} D_i^J + \frac{\lambda[(t_\ell\beta_{\ell i}) \cdot (\frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell^J)]}{t_d+\Sigma(t_\ell\beta_{\ell i})} + \frac{\beta_{\kappa i}}{t_\ell+(t_\ell\beta_{\ell i})} \frac{\alpha_{i\kappa}}{\beta_{\kappa i}} S_\kappa^J \quad (14)$$

By including the communication sector in S_ℓ^J we obtain:

$$S_i^J = \frac{t_d}{t_d+\Sigma(t_\ell\beta_{\ell i})} D_i^J + \frac{\sum_{\ell=1}^{n-1}[(t_\ell\beta_{\ell i}) \cdot (\frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell^J)]}{t_d+\Sigma(t_\ell\beta_{\ell i})} \quad (15)$$

Let $\frac{t_d}{t_d+\Sigma(t_\ell\beta_{\ell i})} = \lambda_d$

and $\frac{(t_\ell\beta_{\ell i})}{t_d+\Sigma(t_\ell\beta_{\ell i})} = \lambda_\ell$

Equation (15) can thus be expressed as:

$$S_i^J = \lambda_d D_i^J + \Sigma(\lambda_\ell \frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell^J) \quad (16)$$

Also, from the theoretical formulation of the model, it follows that:[1]

$$\lambda_d + \Sigma\lambda_\ell = 1$$

The attraction coefficients λ_d and λ_ℓ represent the proportional unit of communication cost associated with D_i^J and S_ℓ^J respectively. As such, the values which λ_d and λ_ℓ will take on will determine to what

[1] The sum of the λs equal to one follows directly from our formulation of the model, that is, since

$$\frac{t_d}{t_d+\Sigma(t_\ell\beta_{\ell i})} = \lambda_d \quad \text{and} \quad \frac{\Sigma(t_\ell\beta_{\ell i})}{t_d+\Sigma(t_\ell\beta_{\ell i})} = \Sigma\lambda_\ell$$

Therefore $$\frac{t_d+\Sigma(t_\ell\beta_{\ell i})}{t_d+\Sigma(t_\ell\beta_{\ell i})} = \lambda_d + \Sigma\lambda_\ell = 1$$

extent industry i will be market- or supply-oriented.[1] A value of $\lambda_d' = 1$ will be taken to indicate that industry i is completely market-oriented, i.e., the communication cost associated with exporting one unit of industry i's product is infinitely high. This in turn implies that industry i's growth potential will be determined by the level of excess demand for its finished product in the region where it is located. By the same token, producers of product i, seeking a profitable location, will be attracted to those regions where the level of excess demand is relatively higher than in other regions.[2] Similarly, a value of $\Sigma\lambda_\ell = 1$ will be indicative of the fact that communication costs associated with imports of inputs for industry i are infinitely high, implying that the industry is completely supply-oriented. As before, its growth potential will be determined by the level of excess supply of inputs ℓ in region J.[3] And, likewise, potential producers will be attracted to those regions whose excess supply of inputs ℓ is relatively higher than in other regions.

With regard to intermediate cases, i.e. $1 > \lambda_d > 0$ and $1 > \lambda_\ell > 0$, where communication costs associated with exports and imports of output i and input ℓ respectively are not infinitely high, the industry will most likely give priority either to its regional

[1] L.H. Klaassen and A.C. Van Wickeren, op. cit., p.252.

[2] Excess demand in this context may properly be understood to include inter-temporal growth of demand through autonomous changes in population, incomes, tastes and relative prices.

[3] As in the case of excess demand, excess supply may include changes in the supply of inputs over time. Such changes may arise through new discoveries, land reclamation, growth of education, technological knowledge etc.

demand or to its regional supply of inputs, depending on the respective value of λ_d and λ_ℓ. We may in general hypothesize that with $\lambda_d > \Sigma\lambda_\ell$, the industry's concern will be with regional demand, and the industry will be defined as a market-oriented industry. Conversely, with $\Sigma\lambda_\ell > \lambda_d$, the industry will give a relatively higher weight to its regional inputs requirements, and hence, will be defined as supply oriented.

It should be obvious from the definition of λ's that the level of interregional trade in final goods is inversely related to the values of λ_d, and directly related to the values of $\Sigma\lambda_\ell$. Clearly, a value of $\lambda_d = 1$ will indicate that the regional output of that industry is completely consumed by regional demand. Moreover, as was previously explained, in such cases it is economically infeasible to export any significant proportion of the output. Consequently, interregional trade in final goods will not take place. On the other hand, a high value of λ_ℓ will indicate a high level of interregional trade in final goods, and in extreme cases the entire output produced by the industry may be exported. A similar inference can be derived for interregional trade in intermediate goods. A high value of λ_d will indicate that the required inputs are being imported from outside the region, and lead to interregional trade in intermediate goods.[1] For industries with a low value of λ_d, inputs which are required to complete the production process are found within the region of location, and hence, there will be no, or little, interregional trade in intermediate goods.

[1] The relationship, however, is rather weak, since $\lambda_d = 1$ may also arise if all or a majority of inputs are produced regionally.

For purposes of estimation, we can express the variables in equation (16) as proportions of their corresponding values in the economy as a whole as follows:

$$\frac{S_i^J}{S_i} \cdot S_i = \lambda_d \frac{D_i^J}{D_i} \cdot D_i + \Sigma(\lambda_\ell \frac{\alpha_{i\ell}}{\beta_{\ell i}} \cdot \frac{S_\ell^J}{S_\ell}) \qquad (17)$$

Since $S_i = \frac{S_i}{D_i} \cdot D_i = \frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell$ and $S_i = D_i$

we can write (17) as:

$$\frac{S_i^J}{S_i} = \lambda_d \frac{D_i^J}{D_i} + \Sigma(\lambda_\ell \frac{S_\ell^J}{S_\ell}) \qquad (18)$$

or as:

$$\phi_i^J = \lambda_d \gamma_i^J + \Sigma\lambda_\ell \phi_\ell^J \qquad (19)$$

where $\phi_i^J = \frac{S_i^J}{S_i}$; $\gamma_i^J = \frac{D_i^J}{D_i}$; $\phi_\ell^J = (\frac{S_\ell^J}{S_\ell})$

In later chapters of this study we will be concerned with estimating equation (19), using Canadian data for each of the variables and for all provinces. The estimated value of the coefficients λ_d and λ_ℓ, henceforth referred to in this study as "attraction coefficients", will be used to predict the extent to which the hypothesized factors determine the regional distribution of production activities in Canada. Moreover, the values of the attraction coefficients, both on the demand and the input side, will enable us to predict the influence of the increase in the levels of regional demand and supply in each industry on interregional movement of industrial resources. In other words,

the attraction coefficients, given the regional location factors, will serve as a measure of the degree of attraction which each region will have over future allocation of industrial resources to itself. On the other hand, if the coefficient of attraction for certain industries are found to be non-significant, such industries will be designated as "footloose" with respect to communication costs.[1] In other words, communication costs will play a minor role in determining interregional allocation of footloose industries.

1. L.H. Klaassen and A.C. Van Wickeren, op. cit., p.252.

CHAPTER -IV

THE REGIONAL STRUCTURE OF MANUFACTURING IN THE CANADIAN ECONOMY

1 - Introduction

In previous chapters we have developed the theoretical framework concerning the interregional distribution of industrial resources. It remains to relate these theoretical approaches to an empirical framework, where an attempt will be made to derive the weights in terms of communication costs, that spatial producers associate with each of the two requirements, namely, intermediate inputs and regional demand. This, in turn, will enable us to determine the interregional locational pattern of industries. Our ultimate objective is to determine the locational orientation of given industries as they are determined by communication costs. If the empirical analysis determines a high weight to be associated with the industry's demand, we will conclude that interregional production patterns are primarily determined by the relevant levels of regional demand. Conversely, if the analysis discovers a high weight associated with the industry's intermediate inputs, it will be concluded that the industry's interregional production patterns are primarily determined by the regional supply of its intermediate inputs.

The present chapter deals with the preliminary stages of deriving the relevant locational factors that determine the industry's interregional production patterns. More precisely, it deals with the analysis of the regional data related to each industry's interregional production pattern; its corresponding interregional distribution of

demand; and its interregional supply of basic intermediate input.

The analysis of the regional data, in itself, will provide us with some preliminary conclusions as to the importance of each locational factor in determining the industry's interregional production patterns. This will be arrived at by comparing the industry's production pattern with the distribution of its regional demand, and with its interregional supply of the basic intermediate input. By comparing the interregional distribution of each of the above locational factors with the industry's interregional production pattern, we can arrive at a preliminary conclusion as to which locational factor is more important in determining the industry's locational behavior. This will pave the way for a more rigorous method for determining the industry's locational factors introduced in the next chapter.

The industries which are analyzed from the point of view of their locational requirements include twenty-seven manufacturing industries. Primary industries as well as tertiary or service industries are excluded from the analysis. It is obvious that an exercise involving locational requirements for the latter industries is largely redundant. For primary industries, production locations are determined primarily by natural factors. Firstly, the extraction of minerals can take place only at a site where such minerals exist; agricultural production will have to take place on fertile land; forest activities have to take place where forests exist ... etc. Secondly, the existence of primary industries usually promotes the establishment of secondary or ancillary industries and not vice versa. In other words, the existence of forestry will promote

the creation of lumber industries; agricultural production will promote food processing industries to locate nearby, etc. The reverse, however, is not true, in the sense that lumber industry cannot create forests, nor food processing industries can create agricultural production.

To a large extent, the same generalization applies to service industries. Invariably, such industries are locally oriented. A good example of such an orientation is the case of police protection, which is completely geared to satisfy local needs. Thus, the determination of production location for such industries, through locational factors, is not only redundant but also a futile exercise.

2 - Statistical Sources

The data required to accomplish this study was obtained mostly from Statistics Canada. At the beginning of this thesis, the Structural Division of Statistics Canada was in the process of completing the regional input and output flows, using the same industry classification as the 1966 national input and output table. However, although information for regional intermediate input and output flows was available, with the exception of service industries, there exists virtually no information regarding the final consuming sector. The latter had to be derived from existing statistical information at the national and at the regional level. The procedure used in such derivation is described below.

To derive regional domestic demand for each industry, we used the coefficient relating GNP to the national industry's final domestic demand, and then applied it to GRP (gross regional product),

to obtain the regional final domestic demand for each of the twenty-seven industries. For example, industry i's national domestic consumption was related to GNP by the coefficient β in the following equation:

$$ND_i = \beta GNP \qquad (4.1)$$

where ND_i = domestic demand for industry i at the national level. Regional demand is then derived by assuming that equation 4.1 holds for all regions. Thus, regional demand for industry i is given by equation 4.2[1]

$$D_i^J = \beta GRP^J \qquad (4.2)$$

where D_i^J = domestic final demand for industry i in region J.

The statistical difficulty in using the above procedure is that GRP is not available for any of the provinces in Canada. Accordingly, GRP is derived from PPY (Provincial Personal Income). The procedure used consists in relating GNP to NPY (National Personal Income) as shown by equation 4.3[2]

$$GNP = \alpha NPY \qquad (4.3)$$

Equation 4.3 was, then, assumed to hold, as well, at the provincial level. Thus, the coefficient 'α' was used in conjunction with provincial personal income to derive the respective GRP, as shown by equation 4.4

$$GRP^J = \alpha PPY^J \qquad (4.4)$$

1 The βs appear in appendix 4B for each of the respective industries.

2 The αs appear in appendix 4C together with PPY and GRP.

By using the resulting estimates of GRP in various provinces of Canada (shown in Appendix 4C), the regional domestic demand was determined as previously described, i.e. by using equation 4.2.

The resulting estimates of regional domestic demand are shown in Appendix 4A. The sum of regional domestic demand and intermediate demand is shown in Appendix 4D, while the corresponding regional gross output for the relevant industries is shown in Appendix 4E. Gross regional output and regional domestic demand expressed in percentages of national gross production and national demand for each of the respective industries is shown in Appendix 4F and 4G respectively.

3 - The Basic Supplying Industries

In the previous section, we showed the derivation of all relevant statistical information pertaining to the regional consuming sectors; the results are presented in the appendices to this chapter. In terms of attraction analysis, the implication of considering total regional domestic demand is that each component of demand has an equal attraction coefficient. This means that the λs for each demand component are assumed to be equal, thereby permitting the inclusion of different categories of total domestic demand. However, the same assumption cannot be used for the supplying industries, which inevitably will have different supply attraction coefficients. On the other hand, the inclusion of all supplying industries obviously means that the final equation to be tested will have more regressors than observations. Under such conditions the equation cannot be tested. Consequently, the

alternative is to choose a basic supplying industry and exclude all others under the assumption that their attraction coefficient is approximately equal to zero. This assumption is justifiable on the basis that minor supplying industries will have a weak linkage with their respective consuming industries, reflected in relatively low values of $\beta_{\ell i}$. In other words, $\beta_{\ell i}$ enters directly in the derivation of λ_ℓ as follows:

$$\frac{t_\ell \beta_{\ell i}}{t_d + t_\ell \beta_{\ell i}} = \lambda_\ell$$

It then follows that low values of $\beta_{\ell i}$ will influence λ_ℓ to be relatively low, as well. Hence, we can justify that minor industries will have low attraction coefficients symbolically represented by zero.[1]

The supplying industry relevant to each manufacturing industry is shown in table 1A of the statistical Appendix A. The basic supplying industry[2] is chosen on the reasoning that its size, represented by gross output, is a possible determining factor which limits the size of the industry to which it is a supplier. This may occur if industry i is identified with its basic supplying industry in the sense that the former's production remotely located from the supplying

[1] An alternative explanation may be derived on the basis that since $\beta_{\ell i}$ is small there is no rationale as to why industry i's inter-provincial production patterns should closely correspond to that of the ℓth supplying industry's.

[2] The basic supplying industry to each of the twenty-seven industries is shown in Appendix 4H. The choice of the basic supplying industry is based primarily on the size of $\beta_{\ell i}$. Accordingly, the supplying industry with the largest $\beta_{\ell i}$ is chosen as the basic supplying industry.

industry's will originate disproportionately high communication costs. This circumstance will, accordingly, induce the industry to locate close to its intermediate input source, and to gear production levels to the regional supply of its basic intermediate input. For example, Table 1A, of statistical Appendix A, shows that the Agriculture industry supplies 55.4 per cent of the Meat Products industry's total requirement. Hence, it may very well be that the basic intermediate input, namely, Agriculture, of the Meat Products industry determines production location as well as the size of the latter.[1] In other words, since the basic supplying industry constitutes a major production requirement for the industry in question, we may therefore justifiably hypothesize that the locational site of the former determines that of the latter.

The hypothesis presented in the above paragraph relating the size and location of a given industry to the production level of its basic supplying industry will be affirmed if the analysis of the regional data, to follow, shows a close correspondence of an individual industry's interprovincial production pattern with that of its basic supplying industry. For example, for the Meat Products industry, the hypothesis will be confirmed if the regional data show that provincial variation of the Meat Products industry's gross output is directly related to the provincial distribution of the Agriculture industry's gross output. However, it should be clear that the absence of such a correspondence between the two industries' gross

[1] Here, we are simply hypothesizing that the supplying industry may play a role in determining the size of the purchasing industry. Whether demand or supplying industry plays the leading role remains to be determined in later chapters by estimating the attraction coefficients.

output does not necessarily imply that the Agriculture industry is of minor importance as a supplying industry. It does imply, however, that its location is relatively unimportant in determining the size of the Meat Products industry. Accordingly, it indicates that the Meat Products industry can import its requirements from provinces other than the one where it is located without incurring disproportionately high communication costs. In such cases, the attraction coefficient of the supplying industry will be close to zero, and the industry will be categorized as non-input-oriented, as was indicated in chapter three.

4 - The Regional Economic Structure of Manufacturing Industries

The intent of this section is to introduce and analyze the regional data to be used in the next chapter for purposes of estimating λs, for determining the spatial costs of production associated with the industry's demand and supply of intermediate inputs as identified by chapter three. More specifically, this section will systemize and examine the inter-provincial distribution of production, regional demand, and inter-provincial trade for each of the twenty-seven manufacturing industries. Also, the inter-provincial distribution of gross output of the industry's basic intermediate input will be introduced. This enables us to arrive at some preliminary conclusions as to the industry's relationship both with its regional domestic demand as well as with its supplying industry.

The regional economic structure of industries is represented in a table summarizing their basic regional economic characteristics. For example, column 1 of Table 4.1, representing the regional economic structure of the Meat Products industry, denotes the individual province's share of production of the Meat Products industry in national production. Similarly, column 2 shows the individual province's share of domestic consumption of the Meat Products industry's gross output in terms of national domestic consumption. A comparison of column 1 with column 2 yields interregional exports and imports shown by column 3 and column 4 respectively.[1] In a similar manner, column 5 denotes the inter-provincial distribution of gross output of the Meat Products industry's basic supplying industry, namely Agriculture, and column 6 measures the interregional trade of the latter, as defined in the import equation for intermediate goods, in chapter 3.

It should be noted that columns 3 and 4, in addition to measuring the industry's interregional trade, also show the divergence between the industry's inter-provincial production pattern with its respective inter-provincial distribution of demand. A low level of interregional trade for a given industry's product indicates a close correspondence of the industry's inter-provincial production pattern with its inter-provincial distribution of demand. Such cases, in line with our theoretical arguments, will emerge, basically from

[1] It should be observed that exports and imports are expressed in terms of national production. For example, an interregional trade of 16.98 per cent of the Meat Products industry's output implies that out of total production, 16.98 per cent is consumed by provinces other than where its production takes place.

disproportionately high communication costs associated with the distribution of the industry's final output to consuming centers. To avoid these costs, the industry will choose a production location close to its consuming centers and will, accordingly, gear production only to satisfy local consumption. This locational behavior is statistically reflected in a high value (close to unity) of the industry's demand attraction coefficient (λ_d). Alternatively, the reverse will hold with high levels of the industry's interregional trade; high levels of interregional trade indicate a substantial divergence between the industry's inter-provincial production patterns and its inter-provincial distribution of demand. In other words, the industry's demand attraction coefficient (λ_d) will be relatively low. Accordingly, the industry's locational behavior will be determined by factors other than its regional demand.

In a similar manner, column 6 in addition to denoting interregional trade of intermediate inputs arrived at by taking the difference between column 1 and column 5, $(\phi_i^J - \phi_\ell^J)$[1], also indicates

[1] The algebraic expression $(\phi_i^J - \phi_\ell^J)$ denotes our previous definition of industry i's import of intermediate good ℓ as proportions of their corresponding values for the country as a whole. This is derived as follows:

$$M_{\ell i}^J = \beta_{\ell i} S_i^J - \alpha_{i\ell}^{\circ} S_\ell^J \quad \ldots\ldots\ldots\ldots 2$$

$$\frac{M_{\ell i}^J}{\beta_{\ell i}} = S_i^J - \frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell^J \quad \ldots\ldots\ldots\ldots 2'$$

Since, $S_i = \frac{\alpha_{i\ell}}{\beta_{\ell i}} S_\ell$ equation 2' can be expressed as:

$$\frac{M_{\ell i}^J}{M_{\ell i}} = \frac{S_i^J}{S_i} - \frac{S_\ell^J}{S_\ell} \quad \text{or as} \quad \frac{M_{\ell i}^J}{M_{\ell i}} = \phi_i^J - \phi_\ell^J$$

differences between the industry's inter-provincial production pattern with its supplying industry's. In other words, since the ith industry (S_i) is equated at the national level to industry ℓ (S_ℓ) by the ratio $\alpha_{i\ell}/\beta_{\ell i}$, any divergences occurring at the regional level between the two respective industries, must therefore be caused by interregional differences in their production patterns which simultaneously account for industry i's interregional trade of intermediate good ℓ.

Accordingly, the level of interregional trade for industry i's intermediate good reflects the extent to which the supplying industry determines interregional production patterns for the former industry. Low levels of industry i's interregional trade for intermediate good ℓ indicate a close correspondence between industry i's inter-provincial production patterns with those of its supplying industries. Such relationships emerge as a consequence of relatively high communication costs associated with the interregional movement of industry i's basic intermediate good. The industry will, therefore, attempt to avoid these excessive spatial costs by seeking a production location close to its input source, and by adjusting production to the regional supply of its intermediate input. Hence, such locational behavior contributes to relatively low levels of the industry's interregional movement of its basic intermediate input. Alternatively, opposite conclusions follow for relatively high levels of industry's interregional trade of its intermediate input, which indicate a relatively large divergence of the industry's interregional production pattern with that of its supplying industry. These cases reflect low spatial costs of production associated with the industry's supply of intermediate input, which, in turn, are instrumental in prompting the industry to choose production loca-

tions remote from its input sources. The consequence of such locational behavior is seen through relatively large interregional movement of the ℓth intermediate good.

Thus, the level of industry i's interregional trade for final and intermediate goods may be taken to represent the degree of correspondence between the industry's interregional production patterns with its regional distribution of demand and with that of its supplying industries. Hence, preliminary conclusions regarding a particular industry's dominant locational factor may be derived simply by comparing the level of industry i's interregional trade for final goods with that of its intermediate goods. A lower level of interregional trade in final output will indicate that the regional distribution of demand for the industry's final output will have a greater weight in determining the industry's locational behavior. Alternatively, a lower level of interregional trade in intermediate goods will have a higher weight in determining the industry's locational behavior. On the other hand, relatively high levels of interregional trade in the industry's final and intermediate goods will be indicative of a footlooseness with respect to the locational behavior.

The following section describes the regional economic structure of the Meat Products industry as illustrative of its inter-provincial location pattern. The analysis is repeated for Meat Products basic supplying industry, viz. Agriculture. This preliminary description enables us to determine whether the Meat Products industry is demand- or input-oriented. Similar description of all other industries included in our analysis is contained in Appendix 4A of this chapter.

4.1 The Regional Economic Structure of the Meat Products Industry

The regional economic structure of the Meat Products industry, shown in Table 4.1, indicates that production of Meat Products is largely concentrated in Ontario, Quebec and Alberta, together accounting for 76.42 per cent of the industry's national production. The Western provinces, with the exception of Alberta, contribute 19.61 per cent of the industry's total output, while the remaining 3.97 is produced by the Atlantic provinces.

The Meat Products industry's inter-provincial production patterns show marginal divergences from the production patterns of its basic supplying industry, namely Agriculture. This divergence results in an interregional trade equivalent to 16.98 per cent of the industry's final output. Alberta, the third leading province producing Meat Products, exports an amount equal to 11.18 per cent of the industry's total output, followed by Manitoba exporting 4.56 per cent of national production. The remaining 1.24 per cent of the industry's regional exports are accounted for by Prince Edward Island, New Brunswick and Saskatchewan. Provinces whose consumption exceeds their productive capacity account for the industry's regional imports. Quebec, although the second leading producer of Meat Products, is also the leading importing province. It imports 6.94 per cent of the industry's total output. British Columbia imports 4.71 per cent of the industry's final output. The remaining 5.33 per cent of the industry's national output is imported by Ontario, Nova Scotia and Newfoundland.

TABLE 4.1 THE REGIONAL ECONOMIC STRUCTURE OF THE MEAT PRODUCTS INDUSTRY (in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (AGRICULTURE)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(c_i^J - c_2^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.12	1.27	-	1.15	0.22	- 0.10
2	Prince Edward Island	0.65	0.42	0.23	-	0.79	- 0.14
3	Nova Scotia	0.84	2.47	-	1.63	1.21	- 0.37
4	New Brunswick	2.63	2.12	0.51	-	1.02	+ 1.61
5	Quebec	21.44	28.38	-	6.94	12.97	+ 8.47
6	Ontario	36.68	39.23	-	2.55	27.91	+ 8.77
7	Manitoba	9.16	4.60	4.56	-	8.14	+ 1.02
8	Saskatchewan	4.70	4.20	0.50	-	25.01	-20.31
9	Alberta	18.03	6.85	11.18	-	18.56	- 0.53
10	British Columbia	5.75	10.46	-	4.71	4.18	+ 1.57
	Canada	100	100	16.98	16.98	100	21.45

The Meat Products industry's inter-provincial production patterns show a significant divergence from its basic supplying industry's, namely Agriculture. This, as previously explained, is reflected in the relatively large interregional flow of the Meat Products industry's intermediate products, equivalent to 21.45 per cent of the industry's total output.

Thus, in view of the above, it seems that the Meat Products industry's inter-provincial production location is not strongly related either to its regional demand or to its intermediate supplying industry. We can, therefore, conclude that at the provincial level, the Meat Products industry exhibits characteristics of a footloose industry.

APPENDIX 4A

4.2 The Regional Economic Structure of the Dairy Products Industry

The regional economic structure of the Dairy Products industry, shown in Table 4.2, indicates that a relatively large share of total production is concentrated in Quebec and Ontario, accounting for 75.48 per cent of national production. The Western provinces account for 19.14 per cent of national production, and the remaining share of 5.38 per cent is produced by the Atlantic provinces.

The inter-provincial consumption pattern of Dairy Products, (column 2), shows a close correspondence to the industry's inter-provincial production location. This is indicated by the industry's relatively low level of interregional trade for final goods (7.95 per cent). The major portion of the industry's regional exports are contributed by Quebec (7.60 per cent) while a negligible proportion (0.35 per cent) is accounted by Prince Edward Island. The other eight provinces account for the industry's regional imports. British Columbia is the leading importing province, importing 3.08 per cent of the industry's regional imports, and 33 per cent of its own consumption needs. Manitoba and Newfoundland import 1.04 per cent and 1.00 per cent of the total traded respectively. The other provinces account for the remaining 2.83 per cent of the industry's regional imports.

TABLE 4.2 THE REGIONAL ECONOMIC STRUCTURE OF THE DAIRY PRODUCTS INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (AGRICULTURE)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\rho_i^J - \rho_x^J)$ / M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.34	1.34	-	1.00	0.22	+ 0.12
2	Prince Edward Island	0.88	0.53	0.35	-	0.79	+ 0.09
3	Nova Scotia	2.37	2.66	-	0.29	1.21	+ 1.16
4	New Brunswick	1.78	2.20	-	0.42	1.02	+ 0.76
5	Quebec	36.39	28.79	7.60	-	12.97	+23.42
6	Ontario	39.09	39.41	-	0.32	27.91	+11.18
7	Manitoba	3.37	4.41	-	1.04	8.14	- 4.77
8	Saskatchewan	3.32	4.26	-	0.94	25.01	-21.69
9	Alberta	6.27	7.13	-	0.86	18.56	-12.29
10	British Columbia	6.18	9.26	-	3.08	4.78	+ 2.00
	Canada	100	100	7.95	7.95	100	-38.75

Alternatively, large divergences are observed by comparing the Dairy Products industry's inter-provincial production pattern (column 1), with that of its basic supplying industry's (column 5). Such divergences in the two industries' inter-provincial production patterns are reflected in the relatively high level of the Dairy Products industry's interregional trade for intermediate goods, (38.75 per cent), as shown by column 6 of Table 4.2. This, in itself, is sufficient evidence that inter-provincial location pattern of the Dairy Products industry's basic supplying industry, namely Agriculture, does not determine inter-provincial location pattern for the former industry. In fact, in view of the close relationship between the Dairy Products industry's inter-provincial production pattern and inter-provincial consumption of Dairy Products, it seems justifiable to conclude that the industry's inter-provincial locational behavior is largely determined by inter-provincial consumption patterns of Dairy Products.

4.3 The Regional Economic Structure of the Fish Products Industry

The regional economic structure of the Fish Products industry, shown in Table 4.3, indicates that national production of Fish Products is largely concentrated in four provinces, namely Newfoundland, Nova Scotia, New Brunswick and British Columbia, which together account for 87 per cent of the national production. The remaining 13 per cent of the industry's national production is

accounted for by the other six provinces.

The Fish Products industry's inter-provincial production pattern (column 1) shows a relatively large divergence from its inter-provincial consumption pattern, (column 2). This is reflected in the high level of interregional trade in industry's products, equivalent to 68.65 per cent of total production. The leading producing provinces are the leading exporting provinces, as well. They account almost completely for the industry's regional exports. In fact, the major portion of the leading producing provinces' final output is consumed by other provinces: Quebec and Ontario together supply 56.19 per cent of the industry's regional imports. The remaining 12.46 per cent is accounted for by Alberta, Saskatchewan and Manitoba.

Alternatively, a close correspondence exists between the Fish Products industry's inter-provincial production pattern and that of its basic supplying industry, namely Fishing and Trapping industry. This can be seen in the relatively low level of interregional trade of its chief intermediate product, equivalent to 9.89 per cent of total production. The close correspondence between the two industries' inter-provincial production patterns, together with the lack of correspondence between the Fish Products industry's inter-provincial production and consumption patterns leads one to conclude that the Fish Products industry's inter-provincial locational behavior is largely influenced by its supplying industry's inter-provincial production patterns.

TABLE 4.3 THE REGIONAL ECONOMIC STRUCTURE OF THE FISH PRODUCTS INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (FISHING AND TRAPPING)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(c_i^J - c_2^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	13.75	3.44	10.31	-	14.65	- .90
2	Prince Edward Island	1.75	0.28	1.47	-	3.45	-1.70
3	Nova Scotia	27.54	5.43	22.11	-	26.83	+ 0.71
4	New Brunswick	9.87	1.94	7.93	-	6.05	+3.82
5	Quebec	4.07	25.97	-	21.90	5.15	-1.08
6	Ontario	2.61	36.90	-	34.29	5.02	-2.41
7	Manitoba	2.29	4.23	-	1.94	2.99	-0.70
8	Saskatchewan	0.18	4.03	-	3.85	2.02	-1.84
9	Alberta	0.07	6.74	-	6.67	1.32	-1.25
10	British Columbia	37.87	11.04	26.83	-	32.51	+5.36
	Canada	100	100	68.65	68.65	100	9.89

4.4 The Regional Economic Structure of the Grain Mill Industry

The regional economic structure of the Grain Mill industry, (Table 4.4), indicates that its production is concentrated in Quebec and Ontario, together accounting for 71.57 per cent of the industry's national production. The Western provinces account for 25.51 per cent of national production, and the remaining 2.92 per cent is contributed by the Atlantic provinces.

The Grain Mill industry's inter-provincial production patterns follow a close correspondence to its consumption pattern. As a result, the interregional flow of the industry's final product amounts to only 7.71 per cent of national production. The Atlantic provinces and British Columbia constitute the importing provinces, while the three remaining Western provinces constitute the exporting provinces.

Alternatively, the Grain Mill industry's inter-provincial production patterns show significant variation from its basic supplying industry's, giving rise to a relatively large interregional trade flows of the industry's intermediate product, amounting to 31.14 per cent of the industry's total production. The lack of correspondence between the two industries' inter-provincial production patterns, together with the close relationship between inter-provincial production and consumption patterns, indicates that the Grain Mill industry is likely to have a preference for locating in provinces with large consuming centres. By the same token, the supplying industry, namely, Agriculture, exerts only a minor influence in determining the Grain Mill industry's inter-provincial locational behavior.

TABLE 4.4 REGIONAL ECONOMIC STRUCTURE OF THE GRAIN MILL INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (AGRICULTURE)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(c_i^J - c_o^J)$ / M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.14	0.76	-	0.62	0.22	- 0.08
2	Prince Edward Island	0.26	0.68	-	0.42	0.79	- 0.53
3	Nova Scotia	1.19	2.56	-	1.37	1.21	- 0.02
4	New Brunswick	1.32	1.81	-	0.49	1.02	- 0.30
5	Quebec	30.28	30.99	-	0.71	12.97	+17.31
6	Ontario	41.29	41.29	-	-	27.91	+13.38
7	Manitoba	5.93	4.40	1.53	-	8.14	- 2.21
8	Saskatchewan	6.47	2.64	3.83	-	25.01	-18.54
9	Alberta	8.78	6.43	2.35	-	18.56	- 9.78
10	British Columbia	4.33	8.43	-	4.10	4.18	+ 0.15
	Canada	100	100	7.71	7.71	100	31.14

4.5 The Regional Economic Structure of the Food & Soft Drink Industry

The regional economic structure of the Food & Soft Drink industry, shown in Table 4.5, indicates that production is basically concentrated in Quebec and Ontario, together accounting for 76.72 per cent of national production. The Western provinces account for 16.81 per cent, and the remaining share of 6.47 per cent of national production is accounted for by the Atlantic provinces.

The industry's inter-provincial production and consumption patterns seem to be closely related, as indicated by columns 1 and 2 of Table 4.5. As a result, a low level of the industry's total output enters interregional trade, being equivalent to 9.41 per cent of total production. Ontario, the leading producing province, is also the leading exporting province. It accounts for 6.69 per cent of the industry's regional exports, followed by New Brunswick and Quebec each exporting 1.49 and 1.23 per cent of total production respectively. The Western provinces account for most of the industry's regional imports. They import 8.03 per cent of total production. The remaining share of 1.38 per cent of national production is accounted for by the three Atlantic provinces.

Conversely, the industry's inter-provincial production pattern shows a large variation from that of its basic supplying industry, giving rise to a relatively high level of interregional trade in intermediate products, amounting to 43.40 per cent, as shown in column 6 of Table 4.5. This finding, together with the observed close relationship between inter-provincial production and consumption patterns, imply that inter-provincial behavior of the Food & Soft Drink industry is

TABLE 4.5 THE REGIONAL ECONOMIC STRUCTURE OF THE FOOD AND SOFT DRINK INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (AGRICULTURE)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(c_{ij}^{J} - z_{ij}^{J})$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.65	1.28	-	0.63	0.22	+ 0.43
2	Prince Edward Island	0.25	0.30	-	0.05	0.79	- 0.54
3	Nova Scotia	1.91	2.61	-	0.70	1.21	+ 0.70
4	New Brunswick	3.65	2.16	1.49	-	1.02	+ 2.63
5	Quebec	28.37	27.14	1.23	-	12.97	+15.40
6	Ontario	48.35	41.66	6.69	-	27.91	+20.44
7	Manitoba	4.40	4.46	-	0.06	8.14	- 3.74
8	Saskatchewan	1.23	3.84	-	2.61	25.01	-23.78
9	Alberta	3.22	6.65	-	3.43	18.56	-15.34
10	British Columbia	7.96	9.89	-	1.93	4.18	+ 3.78
	Canada	100	100	9.41	9.41	100	43.40

basically determined by inter-provincial consumption patterns. By the same token, inter-provincial production patterns of Agriculture, the basic supplying industry of the Food & Soft Drink industry, does not appear to be a relevant factor in determining the latter industry's locational behavior.

4.6 The Regional Economic Structure of the Alcoholic Beverage Industry

The regional economic structure of the Alcoholic Beverage industry, shown in Table 4.6, indicates that most of its production takes place in Ontario and Quebec, accounting for 52.92 and 24.17 per cent of national production respectively. The Western provinces produce 18.16 per cent of national production. British Columbia alone accounts for 9.44 per cent of total production, or 52 per cent of the Western provinces' total production. The remaining share of 4.75 of national production is produced by the Atlantic provinces.

The Alcoholic Beverage industry's inter-provincial production pattern shows marginal divergences from inter-provincial consumption patterns of the industry's final output. Thus, one observes an inter-regional flow of the industry's final output of 11.17 per cent of total production. Ontario is the only exporting province, and also, by far, the leading producing province. It exports 11.71 per cent of the industry's national production. The remaining nine provinces account for the industry's regional import. The Western provinces import 8.14 per cent of the industry's national production; Quebec imports 1.70 per cent, and the remaining share of 1.86 of national production is imported by the Atlantic provinces.

TABLE 4.6 THE REGIONAL ECONOMIC STRUCTURE OF THE ALCOHOLIC BEVERAGE INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (PULP AND PAPER)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - c_i^J)$ / M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	1.41	1.42	-	0.01	2.58	- 1.17
2	Prince Edward Island	0	0.32	-	0.32	-	-
3	Nova Scotia	1.96	2.77	-	0.81	1.61	+ 0.35
4	New Brunswick	1.38	2.11	-	0.73	5.09	- 3.71
5	Quebec	24.17	25.87	-	1.70	35.60	-11.43
6	Ontario	52.92	41.21	11.71	-	35.01	+17.91
7	Manitoba	2.36	4.32	-	1.96	1.72	+ 0.64
8	Saskatchewan	2.06	4.32	-	2.26	0.14	+ 1.92
9	Alberta	4.30	7.18	-	2.88	1.58	+ 2.72
10	British Columbia	9.44	10.48	-	1.04	16.70	- 7.26
	Canada	100	100	11.71	11.71	100	23.54

The industry's inter-provincial production pattern shows substantial variations from its basic supplying industry's. This is reflected in the relatively high level of the industry's interregional trade for intermediate products equivalent to 23.54 per cent, as shown in column 6 of Table 4.6. In view of this, one would expect that the Alcoholic Beverage industry in seeking a production location may have a marginal preference for provinces with actual or potential sources of consuming centres. Nevertheless, the loose relationship between the industry's inter-provincial production patterns with its basic supplying industry's, and to a lesser extent, with inter-provincial consumption patterns, seem to highlight features attributed to a footloose industry, or at least, features reflecting low spatial costs associated with the distribution of the industry's final output and its basic intermediate input.

4.7 The Regional Economic Structure of the Tobacco Industry

The regional economic structure of the Tobacco industry, shown in Table 4.7, indicates that Quebec and Ontario constitute the only producing provinces, accounting for 50.31 and 49.69 per cent of national production respectively. On the other hand, they consume only 36.80 and 37.98 per cent of the industry's total production respectively, giving rise to interregional trade of the industry's final product to the tune of 25.22 per cent of national production. The Western provinces consume 20.12 per cent of total production, while the remaining 5.10 per cent of national production is consumed by the Atlantic provinces.

TABLE 4.7 THE REGIONAL ECONOMIC STRUCTURE OF THE TOBACCO INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (AGRICULTURE)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_i^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	1.11	-	1.11	0.22	- 0.22
2	Prince Edward Island	0	0.25	-	0.25	0.79	- 0.79
3	Nova Scotia	0	2.13	-	2.13	1.21	- 1.21
4	New Brunswick	0	1.61	-	1.61	1.02	- 1.02
5	Quebec	50.31	36.80	13.51	-	12.97	+37.34
6	Ontario	49.69	37.98	11.71	-	27.91	+21.78
7	Manitoba	0	3.34	-	3.34	8.14	- 8.14
8	Saskatchewan	0	3.35	-	3.35	25.01	-25.01
9	Alberta	0	5.53	-	5.53	18.56	-18.56
10	British Columbia	0	7.90	-	7.90	4.18	- 4.18
	Canada	100	100	25.22	25.22	100	59.12

The industry's inter-provincial production pattern shows large variations from its basic supplying industry's. This is reflected in the high level of interregional trade in industry's intermediate product, equivalent to 59.12 per cent of total production. Thus, it seems reasonable to conclude that the Tobacco industry may be footloose with respect to its locational relationships.

4.8 The Regional Economic Structure of the Rubber Industry

The regional economic structure of the Rubber industry, shown in Table 4.8, indicates that most of its production is concentrated in Ontario and Quebec, which account for 75.98 per cent and 20.82 per cent of total production respectively. The remaining share of 3.2 per cent of national production is produced by the Western provinces.

The Rubber industry's inter-provincial production pattern shows a significant variation from inter-provincial consumption patterns of the industry's final output. This gives rise to a relatively high level of interregional trade for the industry's final goods, equivalent to 20.97 per cent of total production. Ontario, with a concentration of national production equal to 75.98 per cent, consumes only 55.01 per cent of the industry's national production, contributing roughly all of the industry's regional exports. The remaining provinces account for the industry's regional imports: The Atlantic provinces 3.83 per cent of total production; Quebec, 3.71 per cent; and the Western provinces 13.43 per cent of total production.

The Rubber industry's inter-provincial production patterns also show significant variations from its basic supplying industry's, as shown by the relatively high interregional trade of the industry's

TABLE 4.8 THE REGIONAL ECONOMIC STRUCTURE OF THE RUBBER INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (INDUSTRIAL CHEMICALS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\varphi_i^J - \varphi_z^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	0.66	-	0.66	0.12	- 0.12
2	Prince Edward Island	0	0.17	-	0.17	0	-
3	Nova Scotia	0	1.89	-	1.89	0.25	- 0.25
4	New Brunswick	0	1.11	-	1.11	0.60	- 0.60
5	Quebec	20.82	24.53	-	3.71	17.90	+ 2.92
6	Ontario	75.98	55.01	20.97	-	61.76	+14.22
7	Manitoba	0.01	3.53	-	3.53	0.37	- 0.36
8	Saskatchewan	0	2.46	-	2.46	1.27	- 1.27
9	Alberta	2.86	4.70	-	1.84	9.67	- 6.81
10	British Columbia	0.34	5.95	-	5.61	8.06	- 7.72
	Canada	100	100	20.97	20.97	100	17.14

intermediate product, equivalent to 17.14 per cent of total production. These findings, together with the loose relationship between the industry's interprovincial production and consumption patterns of Rubber Products, may indicate that the Rubber industry is footloose with respect to spatial costs of production.

4.9 The Regional Economic Structure of the Leather Industry

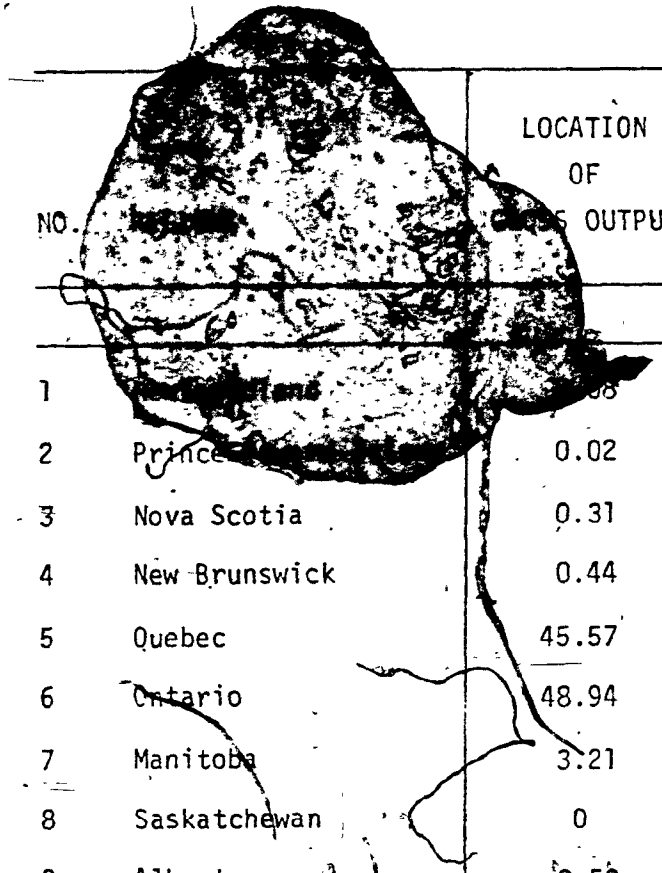
The regional economic structure of the Leather industry, (Table 4.9), shows the industry's production to be mostly concentrated in Quebec and Ontario. Each produces 45.57 and 48.94 per cent of national production respectively, and together produce 94.51 per cent of national production. The Western provinces produce only 4.65 per cent of national production. The remaining 0.85 per cent is produced by the Atlantic provinces.

The Leather industry's inter-provincial production patterns show significant variations from inter-provincial consumption patterns of the industry's final output. This circumstance generates a relatively high level of interregional trade in industry's final goods, amounting to 20.70 per cent of total production. The leading producing provinces, Quebec and Ontario, account for all of the industry's export: 11.97 per cent and 8.73 per cent of total production respectively. The other eight provinces constitute the importing provinces. The Atlantic provinces import a share of 4.48 per cent of the industry's total production, while the remaining 16.22 per cent is imported by the Western provinces.

The Leather industry's inter-provincial production pattern shows significant variations from its basic supplying industry's. This is

TABLE 4.9 THE REGIONAL ECONOMIC STRUCTURE OF THE LEATHER INDUSTRY

(in percentages)



NO.		LOCATION OF OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (RUBBER)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - c_i^J)$ M(+) X(-)
			2	3	4	5	6
1	[illegible]	[illegible]	1.12	-	1.04	0	+ 0.08
2	Prince [illegible]	0.02	0.25	-	0.23	0	+ 0.02
3	Nova Scotia	0.31	2.16	-	1.85	0	+ 0.31
4	New Brunswick	0.44	1.80	-	1.36	0	+ 0.44
5	Quebec	45.57	33.58	11.97	-	20.82	+24.75
6	Ontario	48.94	40.21	8.73	-	75.98	-27.04
7	Manitoba	3.21	4.05	-	0.84	0.01	+ 3.20
8	Saskatchewan	0	3.31	-	3.31	0	-
9	Alberta	0.53	5.52	-	4.99	2.86	- 2.33
10	British Columbia	0.91	7.99	-	7.08	0.34	+ 0.57
	Canada	100	100	20.70	20.70	100	29.37

reflected in the relatively high level of the industry's interregional trade for intermediate products, equivalent to 29.37 per cent of total production. In view of the loose relationship between the industry's inter-provincial production patterns with its basic supplying industry's as well as with inter-provincial consumption patterns of its final output, it may be concluded that the Leather industry is footloose with respect to spatial costs of production.

4.10 The Regional Economic Structure of the Textile Industry

The regional economic structure of the Textile industry (Table 4.10), indicates that 95.43 per cent of the industry's total production is concentrated in Quebec and Ontario: 54.88 and 40.55 per cent of total production respectively. The Atlantic provinces produce 1.82 per cent of the industry's national production, and the remaining share of 2.73 per cent is produced by the Western provinces.

The Textile industry's inter-provincial production pattern indicates a marginal divergence from inter-provincial consumption patterns of the industry's final output, creating an interregional trade flow amounting to 10.97 per cent of the industry's national production. Quebec, the leading producing province, accounts for most of the industry's regional exports. It exports 10.38 per cent of the industry's total production, while Ontario consumes most of its production, and exports only 0.59 per cent of the industry's national output. The Atlantic provinces import 1.27 per cent of the industry's total production, and the remaining 9.70 per cent is imported by the Western provinces.

TABLE 4.10 THE REGIONAL ECONOMIC STRUCTURE OF THE TEXTILE INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (INDUSTRIAL CHEMICALS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\frac{J}{i} - \frac{J}{2})$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	0.58	-	0.58	0.12	- 0.12
2	Prince Edward Island	0.11	0.19	-	0.08	0	+ 0.11
3	Nova Scotia	1.39	1.44	-	0.05	0.25	+ 1.14
4	New Brunswick	0.32	0.88	-	0.56	0.60	- 0.28
5	Quebec	54.88	44.50	10.38	-	17.90	+36.98
6	Ontario	40.55	39.96	0.59	-	61.76	-21.21
7	Manitoba	0.93	3.17	-	2.24	0.37	+ 0.56
8	Saskatchewan	0.09	1.65	-	1.56	1.27	- 1.18
9	Alberta	0.68	3.15	-	2.47	9.67	- 8.99
10	British Columbia	1.03	4.46	-	3.43	8.06	- 7.03
	Canada	100	100	10.97	10.97	100	38.81

The Textile industry's interprovincial production patterns show significant variations from its basic supplying industry's. This is reflected in the relatively high level of interregional trade for the industry's intermediate product, equivalent to 38.81 per cent of total production. In view of this, it seems reasonable to conclude that the distribution of regional demand for final output is a significant factor in determining the textile industry's interprovincial locational behavior, while its basic supplying industry exerts only a minor influence on its locational behavior.

4.11 The Regional Economic Structure of the Clothing Manufacturing Industry

The regional economic structure of the Clothing Manufacturing industry, shown in Table 4.11, indicates that Quebec and Ontario produce 89.37 per cent of the industry's total production: 64.42 and 24.95 per cent of national production respectively. The Atlantic provinces produce only 0.39 per cent of the national production, while the remaining 10.24 per cent is produced by the Western provinces.

The industry's inter-provincial production pattern varies significantly from inter-provincial consumption patterns of the industry's final output, giving rise to relatively large inter-provincial flow of 38.33 per cent of the industry's gross output. Quebec, by far the leading producing province, exports 36.58 per cent of the industry's total production. Manitoba exports the remaining 1.75 per cent. The remaining eight provinces account for the industry's import. The Atlantic provinces import 5.97 per cent of total production; Ontario, the leading importing province, imports 14.54 per cent of the industry's total production. The remaining share per cent is imported by the other three Western provinces.

share of 4.99 per cent of national production is exported by the Atlantic provinces. Ontario, although one of the leading producing provinces, accounts for most of the industry's regional imports; 13.07 per cent of the industry's gross output. The Prairie provinces import 5.90 per cent, while Prince Edward Island imports the remaining 0.15 per cent of the industry's total production.

The Pulp & Paper industry's inter-provincial production patterns vary significantly from its basic supplying industry's. This is indicated by the relatively high level of the industry's interregional trade for intermediate inputs, namely Forestry products, equivalent to 33.78 per cent of the latter's total production. In view of this, one may conclude that interprovincial consuming patterns is a significant factor in determining the Pulp & Paper industry's inter-provincial locational behavior.

4.15 The Regional Economic Structure of the Printing & Publishing Industry

The regional economic structure of the Printing & Publishing industry, shown in Table 4.15, indicates that 81.38 per cent of the industry's national production is produced by Quebec and Ontario, Quebec accounting for 28.13 per cent and Ontario 53.25 per cent of the industry's national production. The Western provinces produce 15.97 per cent of the industry's total production, and the remaining 2.65 per cent is produced by the Atlantic provinces.

The Printing & Publishing industry's inter-provincial production patterns show a close correspondence to inter-provincial consumption patterns of the industry's final output. This is indicated by the relatively low level of the industry's interregional trade in final products,

TABLE 4.15 THE REGIONAL ECONOMIC STRUCTURE OF THE PRINTING AND PUBLISHING INDUSTRY

(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING-INDUSTRY (PULP AND PAPER)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(c_i^J - c_i^J)$ / M(+)-X(-)
		1	2	3	4	5	6
1	Newfoundland	0.36	1.00	-	0.64	2.58	- 2.22
2	Prince Edward Island	0.14	0.14	-	-	0	+ 0.14
3	Nova Scotia	1.29	2.05	-	0.76	1.61	- 0.32
4	New Brunswick	0.86	1.71	-	0.85	5.09	- 4.23
5	Quebec	28.13	27.11	1.02	-	35.60	- 7.47
6	Ontario	53.25	46.92	6.33	-	35.01	+18.24
7	Manitoba	4.32	3.97	0.35	-	1.72	+ 2.60
8	Saskatchewan	1.54	3.14	-	1.60	0.14	+ 1.40
9	Alberta	3.51	5.50	-	1.99	1.58	+ 1.93
10	British Columbia	6.60	8.46	-	1.86	16.70	-10.10
	Canada	100	100	7.70	7.70	100	24.34

equivalent to 7.70 per cent of total production. Ontario, Quebec and Manitoba constitute the exporting provinces, with a share of 6.33 per cent, 1.02 per cent and 0.35 per cent of the industry's total production respectively. The Atlantic provinces and the Western provinces account for the industry's regional imports: 2.25 per cent and 5.45 per cent of the industry's total production respectively.

The Printing & Publishing industry's inter-provincial production patterns show a significant variation from its basic supplying industry's. This is reflected in the relatively high level of the industry's interregional trade for intermediate goods, namely Pulp & Paper products, equivalent to 24.34 per cent of the industry's national production. This, together with the close correspondence between inter-provincial production and consumption patterns, is sufficient to indicate that the Printing & Publishing industry's inter-provincial locational behavior is determined by inter-provincial consumption patterns of its final output.

4.16 The Regional Economic Structure of the Iron & Steel Industry

The regional economic structure of the Iron & Steel industry, shown in Table 4.16, indicates that production is mostly concentrated in Ontario, which accounts for 76.99 per cent of the industry's total production. This is followed by Quebec producing 11.05 per cent of national production, the Atlantic provinces 4.15 per cent, and the Western provinces 7.80 per cent respectively.

The Iron & Steel industry's inter-provincial production pattern deviates marginally from inter-provincial consumption patterns of its

TABLE 4.16 THE REGIONAL ECONOMIC STRUCTURE OF THE IRON AND STEEL INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (MINES)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.10	0.28	-	0.18	10.55	-10.45
2	Prince Edward Island	0	0.03	-	0.03	0	0
3	Nova Scotia	4.02	1.28	2.74	-	2.66	+ 1.36
4	New Brunswick	0.03	0.78	-	0.75	2.16	- 2.13
5	Quebec	11.05	21.59	-	10.54	29.86	-18.81
6	Ontario	76.99	62.40	14.59	-	32.55	+44.44
7	Manitoba	1.29	2.73	-	1.44	5.11	- 3.82
8	Saskatchewan	1.32	1.55	-	0.23	6.30	- 4.98
9	Alberta	2.68	3.61	-	0.93	0.82	+ 1.86
10	British Columbia	2.51	5.74	-	3.23	10.00	- 7.49
	Canada	100	100	17.33	17.33	100	47.66

final output. This gives rise to an interregional trade flow of 17.33 per cent of the industry's final output. Ontario, the leading producing province, accounts for most of the industry's regional export, amounting to 14.59 per cent of total production. Nova Scotia exports the remaining 2.74 per cent of total production. The other eight provinces account for the industry's regional imports. Quebec, the second leading producing province, is also the largest importing province. It imports 10.54 per cent of the industry's total production. The Western provinces import 5.83 per cent of total production. The Western provinces import 5.83 per cent of total production, and the remaining 0.96 per cent is imported by the Atlantic provinces.

The Iron & Steel industry's inter-provincial production patterns show abnormally high variations from its basic supplying industry's. This is reflected in the high level of interregional trade in industry's intermediate products, equivalent to 47.66 per cent of the latter's total production. In view of this, we conclude that the Iron & Steel industry, in seeking for a production location, will have a preference to locate in provinces endowed with relatively large consuming centres.

4.17 The Regional Economic Structure of the Non-Ferrous Metal Industry

The regional economic structure of the Non-Ferrous Metal industry, shown in Table 4.17, indicates that production of Non-Ferrous Metal Products is concentrated in Quebec and Ontario which, together, account for 84.53 per cent of national production. The remaining 15.47 per cent of total production is produced by the Western provinces.

The Non-Ferrous Metal industry's inter-provincial production patterns show marginal divergences from inter-provincial consumption patterns

TABLE 4.17 THE REGIONAL ECONOMIC STRUCTURE OF THE NON-FERROUS METAL INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (MINES)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_1^J - \phi_2^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	0.09	-	0.09	10.55	-10.55
2	Prince Edward Island	0	0.01	-	0.01	0	-
3	Nova Scotia	0	0.38	-	0.38	2.66	- 2.66
4	New Brunswick	0	0.28	-	0.28	2.16	- 2.16
5	Quebec	46.61	40.52	6.09	-	29.86	+ 16.75
6	Ontario	37.92	52.49	-	14.57	32.55	+ 5.37
7	Manitoba	4.58	1.24	3.24	-	5.11	- 0.53
8	Saskatchewan	0.99	0.53	0.46	-	6.30	- 5.31
9	Alberta	1.64	1.20	0.44	-	0.82	+ 0.82
10	British Columbia	8.24	3.14	5.10	-	10.00	- 1.76
	Canada	100	100	15.33	15.33	100	22.94

of Non-Ferrous Metal Products, giving rise to an interregional flow of 15.33 per cent of the industry's final output. Quebec, the leading producing province, is also the largest exporting province. It exports 6.09 per cent of the total production, while the Western provinces export the remaining 9.24 per cent. Ontario, the second largest producing province, is the leading importing province. It imports 14.57 per cent of the industry's total production. The remaining 0.76 per cent is imported by the Atlantic provinces.

Marginal divergences are, as well, observed to occur between the Non-Ferrous Metal industry's inter-provincial production patterns and its basic supplying industry's. This is indicated by the industry's interregional trade flows for intermediate products, equivalent to 22.94 per cent of national production. In view of these findings, it would seem that the Non-Ferrous Metal industry can be identified as a balanced industry, to the extent that its inter-provincial locational behavior is equally determined by inter-provincial consumption patterns as well as by inter-provincial production patterns of its basic supplying industry, namely, the Mining industry.

4.18 The Regional Economic Structure of the Metal Fabricating Industry

The regional economic structure of the Metal Fabricating industry (Table 4.18) shows that production of Metal Fabricating Products is mainly concentrated in Quebec and Ontario. Together they account for 84.07 per cent of the industry's total production. The Atlantic provinces account for 2.16 per cent of national production, while the remaining 13.76 is produced by the Western provinces.

TABLE 4.18 THE REGIONAL ECONOMIC STRUCTURE OF THE METAL FABRICATING INDUSTRY

(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (IRON AND STEEL)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_2^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.19	0.56	-	0.10	0.28	+ 0.09
2	Prince Edward Island	0.03	0.13	-	0	0.03	+ 0.03
3	Nova Scotia	1.14	1.52	-	4.02	1.28	- 2.88
4	New Brunswick	0.80	1.08	-	0.03	0.78	+ 0.77
5	Quebec	24.53	22.13	2.40	11.05	21.59	+13.48
6	Ontario	59.54	58.47	1.07	76.99	62.40	-17.45
7	Manitoba	2.94	2.75	0.19	1.29	2.73	+ 1.65
8	Saskatchewan	0.96	1.85	-	1.32	1.55	- 0.36
9	Alberta	3.43	4.26	-	2.68	3.61	+ 0.75
10	British Columbia	6.43	7.24	-	2.51	5.74	+ 3.92
	Canada	100	100	3.66	100	100	20.69

The Metal Fabricating industry's inter-provincial production patterns show a close correspondence to inter-provincial consumption patterns of its final goods. Consequently, the interregional trade for final products amounts to only 3.66 per cent of total production. Quebec, Ontario and Manitoba account for the industry's regional exports. The Atlantic provinces and the three Western provinces account for the industry's regional imports, with a share of 1.13 per cent and 2.53 per cent of the industry's total production respectively.

The Metal Fabricating industry's inter-provincial production pattern shows a significant variation from its basic supplying industry's. This is indicated by the relatively high level of the industry's interregional trade for intermediate products, equivalent to 20.69 per cent of the industry's total production. Thus, it would seem that the Metal Fabricating industry is highly demand-oriented. In seeking for a production location, the industry will tend to locate close to its consuming centres.

4.19 The Regional Economic Structure of the Machine Industry

The regional economic structure of the Machine industry (Table 4.19) indicates that production of Machine Products is mainly concentrated in Ontario, producing 75.24 per cent of the industry's total production. It is followed by Quebec producing 15.11 per cent of national production, while the remaining 0.27 per cent and 9.38 per cent of national production is produced by the Atlantic and Western provinces respectively.

The Machine industry's inter-provincial production patterns show a significant divergence from inter-provincial consumption patterns of Machine Products. Hence, one observes an interregional trade flow of 28.27 per cent of the industry's final output. Ontario, the leading

TABLE 4.19 THE REGIONAL ECONOMIC STRUCTURE OF THE MACHINERY INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (METAL FABRICATING)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.04	1.25	-	1.21	0.19	- 0.15
2	Prince Edward Island	0.02	0.29	-	0.27	0.03	- 0.01
3	Nova Scotia	0.16	2.38	-	2.22	1.14	- 0.98
4	New Brunswick	0.05	1.79	-	1.74	0.80	- 0.75
5	Quebec	15.11	23.77	-	8.66	24.53	- 9.42
6	Ontario	75.24	46.97	28.27	-	59.54	+15.70
7	Manitoba	3.40	4.08	-	0.68	2.94	+ 0.46
8	Saskatchewan	0.46	3.98	-	3.52	0.96	- 0.50
9	Alberta	1.48	6.60	-	5.12	3.43	- 1.95
10	British Columbia	4.04	8.89	-	4.85	6.43	- 2.39
	Canada	100	100	28.27	28.27	100	16.16

producing province, accounts for all of the industry's regional exports. Quebec, the Atlantic and the Western provinces account for the industry's regional imports. Each imports 8.66 per cent, 5.44 per cent, and 14.17 per cent of total production respectively.

Alternatively, the Machine industry's inter-provincial production pattern shows only marginal divergences from its basic supplying industry's, namely the Metal Fabricating industry. This is indicated by the relatively low level of the industry's interregional trade for intermediate products, equivalent to 16.16 per total output. These findings suggest that the Machine industry will tend to locate in provinces whose economic structure reflects relatively large undepleted sources of the industry's basic intermediate input.

4.20 The Regional Economic Structure of the Motor Vehicle Industry

The regional economic structure of the Motor Vehicle industry (Table 4.20) indicates that production of Motor Vehicles is primarily concentrated in Ontario: 94.26 per cent of the industry's total production. Quebec, the Atlantic provinces, and the Western provinces, each produce an equivalent share of 2.97 per cent, 0.30 per cent and 2.46 per cent of the industry's national production respectively.

The Motor Vehicle industry's interprovincial production patterns show significant divergences from interprovincial consumption patterns of Motor Vehicle Products, giving rise to a relatively high level of interregional trade for its final goods, equivalent to 27.77 per cent of the industry's total production. Ontario, the leading producing province, accounts for all of the industry regional exports. Quebec, the Atlantic and the Western provinces account for the industry's regional

TABLE 4.20 THE REGIONAL ECONOMIC STRUCTURE OF THE MOTOR VEHICLE INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (IRON AND STEEL)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_k^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	0.86	-	0.86	0.10	- 0.10
2	Prince Edward Island	0	0.19	-	0.19	0	-
3	Nova Scotia	0.23	1.80	-	1.57	4.02	- 3.79
4	New Brunswick	0.07	1.25	-	1.18	0.03	+ 0.04
5	Québec	2.97	16.78	-	13.81	11.05	- 8.08
6	Ontario	94.26	66.49	27.77	-	76.99	+17.27
7	Manitoba	0.60	2.80	-	2.20	1.29	- 0.69
8	Saskatchewan	0.02	2.59	-	2.57	1.32	- 1.30
9	Alberta	0.57	0.59	-	0.02	2.68	- 2.11
10	British Columbia	1.27	6.64	-	5.37	2.51	- 1.24
	Canada	100	100	27.77	27.77	100	17.31

import. Each imports 13.81 per cent, 3.80 per cent, and 10.16 per cent of the industry's total output respectively.

Alternatively, only marginal divergences are observed to occur between the Motor Vehicle industry's interprovincial production patterns and its basic supplying industry's, namely the Iron & Steel industry. This is indicated by the relatively low level of the industry's interregional trade for intermediate products, equivalent to 17.31 per cent of the industry's total production. In view of this, we conclude that the Iron & Steel industry's inter-provincial production pattern is a significant factor in determining the Motor Vehicle industry's inter-provincial locational behavior.

4.21 The Regional Economic Structure of the Transportation Equipment Industry

The regional economic structure of the Transportation Equipment industry (Table 4.21) shows that 82.97 per cent of the industry's total production is produced in Quebec and Ontario. The Atlantic and Western provinces each produce a share of national production of 8.19 per cent and 8.84 per cent respectively.

The Transportation Equipment industry's inter-provincial production pattern shows a significant divergence from inter-provincial consumption patterns of Transportation Equipment Products, giving rise to an interregional trade flow of 19.94 per cent of the industry's final output. Quebec and Nova Scotia constitute the exporting provinces. Each exports 16.52 per cent and 3.42 per cent of the industry's total production respectively. Ontario, the Atlantic and Western provinces account for the industry's regional imports. Each imports 4.29 per cent, 2.11 per cent, and 13.54 per cent of total production respectively.

TABLE 4.21 THE REGIONAL ECONOMIC STRUCTURE OF THE TRANSPORTATION EQUIPMENT INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (IRON AND STEEL)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.04	1.59	-	1.55	0.10	- 0.15
2	Prince Edward Island	0.17	0.32	-	0.15	0	+ 0.14
3	Nova Scotia	6.50	3.08	3.42	-	4.02	+ 5.36
4	New Brunswick	1.48	1.89	-	0.41	0.03	+ 0.68
5	Quebec	43.00	26.48	16.52	-	11.05	+18.47
6	Ontario	39.97	44.26	-	4.29	76.99	-19.57
7	Manitoba	2.09	3.88	-	1.79	1.29	- 0.84
8	Saskatchewan	0	3.49	-	3.49	1.32	- 0.96
9	Alterta	1.23	5.90	-	4.67	2.68	- 2.20
10	British Columbia	5.51	9.10	-	3.59	2.51	- 0.92
	Canada	100	100	19.94	19.94	100	24.65

Similarly, significant variations are observed between the Transportation Equipment industry's inter-provincial production pattern and its basic supplying industry's, namely the Iron & Steel industry. This is indicated by the relatively high level of the industry's interregional trade for intermediate products, equivalent to 24.65 per cent of the industry's total output. In view of these findings, we conclude that neither inter-provincial consumption patterns of Transportation Equipment products nor the supplying industry's inter-provincial production patterns are significant factors in determining the Transportation Equipment industry's inter-provincial locational behavior. Accordingly, we identify the Transportation Equipment industry to be footloose with respect to its spatial costs of production.

4.22 The Regional Economic Structure of the Electrical Products Industry

The regional economic structure of the Electrical Products industry, shown in Table 4.22, indicates that production is concentrated in Quebec and Ontario. Together, they account for 94.43 per cent of the industry's total production. The Atlantic and Western provinces produce 1.32 per cent and 4.25 per cent of the industry's total production respectively.

The Electrical Products industry's inter-provincial production patterns show marginal variations from inter-provincial consumption patterns of Electrical Products, giving rise to an interregional trade flow of the industry's final output equivalent to 18.21 per cent. Quebec and Ontario constitute the exporting provinces, exporting 2.28 per cent and 15.93 per cent of the industry's total output respectively. The Atlantic and the Western provinces account for the industry's regional import.

TABLE 4.22 THE REGIONAL ECONOMIC STRUCTURE OF THE ELECTRICAL PRODUCTS INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (NON-FERROUS METALS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0	0.94	-	0.94	10.55	-10.55
2	Prince Edward Island	0	0.21	-	0.21	0	-
3	Nova Scotia	0.71	2.44	-	1.73	2.66	- 1.95
4	New Brunswick	0.61	1.54	-	0.93	2.16	- 1.55
5	Quebec	26.27	23.99	2.28	-	29.86	- 3.59
6	Ontario	68.16	52.23	15.93	-	32.55	+35.61
7	Manitoba	1.06	3.20	-	2.14	5.11	- 4.05
8	Saskatchewan	0.38	2.88	-	2.50	6.30	- 5.92
9	Alberta	0.75	5.03	-	4.28	0.82	- 0.07
10	British Columbia	2.06	7.54	-	5.48	10.00	- 7.94
	Canada	100	100	18.21	18.21	100	35.61

Each imports a share of 3.81 per cent and 14.40 per cent of the industry's total output respectively.

Alternatively, significant divergences are observed to occur between the Electrical Products industry's inter-provincial production pattern and its basic supplying industry's, namely the Non-Ferrous Metal industry. This is shown by the relatively high level of the industry's interregional trade for intermediate products, equivalent to 35.61 per cent of total output. In view of this, we conclude that inter-provincial consumption patterns of Electrical Products constitute the more relevant factor in determining its inter-provincial locational behavior.

4.23 The Regional Economic Structure of the Non-Metallic Mineral Industry

The regional economic structure of the Non-Metallic Mineral industry, shown in Table 4.23, indicates that 77.63 per cent of the industry's total production is produced by Quebec and Ontario. The Atlantic and Western provinces each produce 3.18 per cent and 19.19 per cent of the industry's national output respectively.

The Non-Metallic Mineral industry's inter-provincial production patterns show a close correspondence to inter-provincial consumption patterns of final goods. There is accordingly a low level of interregional trade for the industry's final output, equivalent to 7.16 per cent of the industry's total output. Quebec and Alberta account for most of the industry's regional exports. They export 6.74 per cent of the industry's total production. The remaining 0.42 per cent is exported by Newfoundland, New Brunswick and Manitoba. The remaining five provinces account for the industry's regional import. Ontario, the leading producing

TABLE 4.23 THE REGIONAL ECONOMIC STRUCTURE OF THE NON-METALLIC MINERAL PRODUCTS
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (MINES)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.81	0.78	0.03	-	10.55	- 9.74
2	Prince Edward Island	0.02	0.10	-	0.08	0	+ 0.02
3	Nova Scotia	1.21	1.71	-	0.50	2.66	- 1.45
4	New Brunswick	1.14	1.10	0.04	-	2.16	- 1.02
5	Quebec	28.74	25.27	3.47	-	29.86	- 1.12
6	Ontario	48.89	55.18	-	6.29	32.55	+16.34
7	Manitoba	3.10	2.75	0.35	-	5.11	- 2.01
8	Saskatchewan	2.49	2.50	-	0.01	6.30	- 3.81
9	Alberta	7.59	4.32	3.27	-	0.82	+ 6.77
10	British Columbia	6.01	6.29	-	0.28	10.00	- 3.99
	Canada	100	100	7.16	7.16	100	23.13

province, constitutes, as well, the leading importing province. It imports 6.29 per cent of the industry's total output. The remaining share of 0.87 per cent is imported by Prince Edward Island, Nova Scotia, Saskatchewan and British Columbia.

The Non-Metallic Mineral industry's inter-provincial production patterns show marginal divergences from its basic supplying industry's, namely the Mining industry. This is indicated by the level of the industry's interregional trade for intermediate products, equivalent to 23.13 per cent of total output. Thus, in view of these findings, we conclude that inter-provincial consumption patterns for Non-Metallic Mineral Products constitute the more relevant factor in determining the industry's inter-provincial locational behavior.

4.24 The Regional Economic Structure of the Petroleum & Coal Products Industry

The regional economic structure of the Petroleum & Coal Products industry (Table 4.24) shows that Quebec and Ontario produce 61.63 per cent of the industry's total production. The Atlantic and the Western provinces each produce 9.09 per cent and 29.28 per cent of national production respectively.

The Petroleum & Coal Products industry's inter-provincial production patterns show a close correspondence to inter-provincial consumption patterns of Petroleum & Coal Products. This is indicated by the low level of the industry's interregional trade for final products, equivalent to 6.83 per cent of the industry's total output. Nova Scotia, Quebec and Alberta account for most of the industry's regional export. Each exports an equivalent share of 2.77 per cent, 2.16 per cent and 1.04 per cent of the total output respectively. New Brunswick and British

TABLE 4.24 THE REGIONAL ECONOMIC STRUCTURE OF THE PETROLEUM AND COAL PRODUCTS INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (PETROLEUM AND GAS WELLS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ / M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.80	2.00	-	1.20	0	+ 0.80
2	Prince Edward Island	0	0.40	-	0.40	0	0
3	Nova Scotia	5.21	2.44	2.77	-	0	+ 5.21
4	New Brunswick	3.08	2.23	0.85	-	0	+ 3.08
5	Quebec	26.81	24.65	2.16	-	0	+26.81
6	Ontario	34.82	38.70	-	3.88	0.93	+33.89
7	Manitoba	3.93	4.64	-	0.71	1.20	+ 2.73
8	Saskatchewan	6.00	6.64	-	0.64	20.12	-14.12
9	Alberta	9.35	8.31	1.04	-	72.40	-63.05
10	British Columbia	10.00	9.99	0.01	-	5.35	+ 4.65
	Canada	100	100	6.83	6.83	100	77.17

Columbia account for the remaining exports of 0.86 per cent of total production. The other five provinces account for the industry's regional import. Ontario, the leading producing province, is also the leading importing province. It imports 3.88 per cent of the industry's total output. Newfoundland and Prince Edward Island import 1.60 per cent of the industry's gross output. The remaining share of 1.35 per cent is imported by Manitoba and Saskatchewan.

The Petroleum & Coal Products industry's inter-provincial production patterns show abnormally high divergences from its basic supplying industry's, namely the Petroleum & Gas Wells industry. This is indicated by the high level of the industry's interregional trade for intermediate products, equivalent to 77.17 per cent of total output. Thus, in view of this, we conclude that inter-provincial consumption patterns are the more relevant factor in determining the industry's inter-provincial locational behavior.

4.25 The Regional Economic Structure of the Industrial Chemical Industry

The regional economic structure of the Industrial Chemical industry, shown in Table 4.25, indicates that 79.66 per cent of the industry's total production is produced by Quebec and Ontario. The Atlantic and Western provinces each produce 0.97 per cent and 19.73 per cent of the industry's total output respectively.

The Industrial Chemical industry's inter-provincial production pattern shows a close correspondence to inter-provincial production patterns of Industrial Chemical Products. This is indicated by the relatively low level of the industry's interregional trade for final goods, equivalent to 13.67 per cent of total output. Ontario, the leading

TABLE 4.25 THE REGIONAL ECONOMIC STRUCTURE OF THE INDUSTRIAL CHEMICAL INDUSTRY
(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (MINES)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.12	0.40	-	0.28	10.55	-10.43
2	Prince Edward Island	0	0.27	-	0.27	0	0
3	Nova Scotia	0.25	1.03	-	0.78	2.66	- 2.41
4	New Brunswick	0.60	1.72	-	1.12	2.16	- 1.56
5	Quebec	17.90	26.02	-	8.12	29.86	-11.96
6	Ontario	61.76	53.78	7.98	-	32.55	+29.21
7	Manitoba	0.37	2.51	-	2.14	5.11	- 4.74
8	Saskatchewan	1.27	2.23	-	0.96	6.30	- 5.03
9	Alberta	9.67	5.05	4.62	-	0.82	+ 8.85
10	British Columbia	8.06	6.99	1.07	-	10.00	- 1.94
	Canada	100	100	13.67	13.67	100	38.06

producing province, is also the leading exporting province. It exports 7.98 per cent of the industry's total output. Alberta and British Columbia export the remaining share of 5.69 per cent of the industry's total output. The other seven provinces account for the industry's regional import. The Atlantic provinces import 2.45 per cent of the industry's total output; Quebec imports 8.12 per cent; Manitoba and Saskatchewan import the remaining share of 3.10 per cent of the industry's total output.

Alternatively, the Industrial Chemical industry's inter-provincial production patterns show a significant divergence from its basic supplying industry's namely the Mining industry. This is reflected in the relatively high level of the industry's interregional trade for intermediate products, equivalent to 38.06 per cent of the industry's total output. Thus, in view of these findings, we conclude that the Industrial Chemical industry, in seeking a production location, will have a preference to locate close to its consuming centres.

4.26 The Regional Economic Structure of the Chemical Products Industry

The regional economic structure of the Chemical Products industry (Table 4.26) shows that 91.49 per cent of the industry's total production is produced in Quebec and Ontario. The Atlantic and Western provinces each produce 1.33 per cent and 7.18 per cent of total output respectively.

The Chemical Products industry's inter-provincial production patterns show marginal variations from interprovincial consumption patterns of Chemical products, giving rise to an interregional trade of 19.28 per cent of the industry's final output. Quebec and Ontario account for all of the industry's regional exports. The Atlantic and the

TABLE 4.26 THE REGIONAL ECONOMIC STRUCTURE OF THE CHEMICAL PRODUCTS INDUSTRY

(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (INDUSTRIAL CHEMICALS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.13	0.16	-	1.03	0.12	+ 0.01
2	Prince Edward Island	0.27	0.46	-	0.19	0	+ 0.27
3	Nova Scotia	0.36	1.87	-	1.51	0.25	+ 0.11
4	New Brunswick	0.57	1.96	-	1.39	0.60	- 0.03
5	Quebec	32.43	26.42	6.01	-	17.90	+14.50
6	Ontario	59.06	45.79	13.27	-	61.76	- 2.70
7	Manitoba	1.65	3.65	-	2.00	0.37	+ 1.28
8	Saskatchewan	0.17	3.91	-	3.74	1.27	- 1.10
9	Alberta	2.35	6.44	-	4.09	9.67	- 7.32
10	British Columbia	3.01	8.34	-	5.33	8.06	- 5.05
	Canada	100	100	19.28	19.28	100	16.17

Western provinces account for the industry's regional imports. Each imports a share of 4.12 per cent and 15.16 per cent of the industry's gross output respectively.

The Chemical Products industry's inter-provincial production patterns show a close correspondence to its basic supplying industry's, namely the Industrial Chemical industry. This is indicated by the relatively low level of the industry's interregional trade for intermediate products, equivalent to 16.17 per cent of the industry's total output. In view of this, we conclude that the Chemical Products industry, in seeking a production location, will have a marginal preference to locate close to its intermediate supply sources.

4.27 The Regional Economic Structure of the Miscellaneous Manufacturing Industry

The regional economic structure of the Miscellaneous Manufacturing industry, shown in Table 4.27, indicates that 93.32 per cent of the industry's total production is produced by Quebec and Ontario. The Atlantic and Western provinces each produce 1.10 per cent and 5.58 per cent of total output respectively.

The Miscellaneous Manufacturing industry's inter-provincial production patterns show a marginal divergence from inter-provincial consumption patterns of Miscellaneous Manufacturing Products. Thereby, giving rise to the interregional trade of 20.05 per cent of the industry's final output. Ontario, by far the leading producing province, is the only exporting province. The remaining nine provinces account for the industry's regional imports. Quebec imports 2.52 per cent of the industry's total output. The Atlantic and Western provinces each import 3.69 per cent and 13.83 per cent of the industry's total output respectively.

The industry's inter-provincial production patterns show a relatively close correspondence to its basic supplying industry's, namely the Chemical Products industry. This is indicated by the low level of the industry's interregional trade for intermediate products, equivalent to 9.10 per cent of the industry's total output. In view of this, we conclude that the Miscellaneous Manufacturing industry, in seeking a production location, will have a marginal preference to locate close to its intermediate supply sources.

TABLE 4.27 THE REGIONAL ECONOMIC STRUCTURE OF THE MISCELLANEOUS MANUFACTURERS

(in percentages)

NO.	REGIONS	LOCATION OF GROSS OUTPUT	REGIONAL DISTRIBUTION OF DEMAND	INTER-REGIONAL TRADE		BASIC SUPPLYING INDUSTRY (CHEMICAL PRODUCTS)	
				EXPORTS	IMPORTS	GROSS OUTPUT	$(\phi_i^J - \phi_\ell^J)$ M(+) X(-)
		1	2	3	4	5	6
1	Newfoundland	0.05	0.95	-	0.90	0.13	- 0.08
2	Prince Edward Island	0	0.22	-	0.22	0.27	- 0.27
3	Nova Scotia	0.31	2.02	-	1.71	0.36	- 0.05
4	New Brunswick	0.74	1.60	-	0.86	0.57	+ 0.17
5	Quebec	25.50	28.03	-	2.53	32.43	- 6.93
6	Ontario	67.82	47.77	20.05	-	59.06	+ 8.76
7	Manitoba	1.04	3.56	-	2.52	1.65	- 0.61
8	Saskatchewan	0.34	2.83	-	2.49	0.17	+ 0.17
9	Alberta	1.40	5.32	-	3.92	2.35	- 0.95
10	British Columbia	2.80	7.70	-	4.90	3.01	- 0.21
	Canada	100	100	20.05	20.05	100	9.10

CHAPTER V

THE ECONOMETRIC ESTIMATION OF THE MODEL

1 - Introduction

The previous chapter contained a preliminary analysis of the regional data to be used for estimating the attraction coefficients (λ) for a range of industries. This analysis enabled us to arrive at some general conclusions as to which of the industry's locational requirements (local demand and/or local supply of intermediate inputs) is the most significant determinant of its location. However, our methodology was somewhat restricted since it could not properly determine the weight of each of the industry's requirements, and as such was confined to a simple comparison of the industry's interregional pattern of production and consumption in order to determine its input or demand orientation. Also, the analysis assumed that the overall inter-industry relationship for each of the industries was significant as a locational requirement. Although the assumption may apply in most cases, we nevertheless may wish to determine its degree of significance.

The objective of the present chapter is to eliminate the foregoing constraints by introducing the econometric estimation of the attraction coefficients with their corresponding statistical significance (the t statistics), together with the significance which the inter-industry relation framework has as a locational determinant (the multiple correlation coefficient).

2 - Methods of Estimation

The method of three-stage least square was chosen to estimate the attraction coefficients. The rationale for using such an estimating procedure rather than the method of ordinary least square, or that of the second-stage least square, is explained below.

The linear multiple regression model introduced by Johnston and others[1] shows that, given a number of assumptions related to the disturbance term and to the independent variables, the O.L.S.E. can then be shown to be best linear unbiased estimators (B.L.U.E.).[2] This would be true, given an econometric model such as:

$$Y = A + bX + u \qquad (1)$$

where

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_u \end{bmatrix} \qquad X = \begin{bmatrix} 1 & X_{21} & X_{31} & \cdots & X_{k1} \\ 1 & X_{22} & X_{32} & \cdots & X_{k2} \\ \vdots & & & & \\ 1 & X_{2n} & X_{3n} & \cdots & X_{kn} \end{bmatrix}$$

$$u = \begin{bmatrix} u_1 \\ \vdots \\ u_n \end{bmatrix} \qquad b = \begin{bmatrix} b_1 \\ \vdots \\ b_k \end{bmatrix}$$

And given that the following assumptions are satisfied:

i) $E(u) = 0$
ii) $E(uu') = \delta^2 I_u$
iii) X is a set of fixed numbers
iv) X has a rank $k < n$

1 J. Johnston, Econometric Methods, McGraw-Hill Book Company, 1972. Jan Kmenta, Elements of Econometrics, The Macmillan Company, 1971. Theil H., Principles of Econometrics, John Wiley & Sons Inc., 1971.

2 J. Johnston, Ibid., pages 23-24.

The first assumption implies that the disturbance terms are random variables with zero expectations. The second assumption, referred to as homoscedasticity, implies that the variance-covariance matrix of the disturbance term (u) has a variance represented by the constant term $\tilde{0}^2$ (the main diagonal) and a covariance of zero (the off-diagonals), thereby indicating that the disturbance terms are pairwise uncorrelated. The third assumption implies that in repeated samples, the only variation of Y is caused by u. It also indicates that E(X,u) = 0, i.e., the independent variables and the disturbance terms are pairwise uncorrelated. The fourth assumption indicates that the number of observations must exceed the number of variables in the model; otherwise the O.L.S. cannot be estimated.[1] If the model fulfills all the four assumptions outlined, it can be shown that O.L.S. estimators are B.L.U.E.[2]

The model proposed for this study whose reduced form is represented by equation (2) below is a simultaneous equation model, in the

$$\phi_i^J = \lambda_d \gamma_i^S + \lambda_\ell \phi_\ell^J + u_i \qquad (2)$$

where

$$\phi_i^J = \begin{bmatrix} \phi_6^1 & \phi_6^2 \cdots\cdots\cdots\cdots & \phi_6^{10} \\ \phi_7^1 & \phi_7^2 \cdots\cdots\cdots\cdots & \phi_7^{10} \\ \vdots & \vdots \quad \ddots & \vdots \\ \phi_{32}^1 & \phi_{32}^1 \cdots\cdots\cdots\cdots & \phi_{32}^{10} \end{bmatrix}$$

[1] J. Johnston, op. cit., pages 121-23.

[2] For details, the reader is referred to Johnston, op. cit.

$$\gamma_i^J = \begin{bmatrix} \gamma_6^1 & \gamma_6^2 \cdots\cdots & \gamma_6^{10} \\ \gamma_7^1 & \gamma_7^2 \cdots\cdots & \gamma_7^{10} \\ \vdots & \vdots \quad \ddots & \vdots \\ \gamma_{32}^1 & \gamma_{32}^2 \cdots\cdots & \gamma_{32}^{10} \end{bmatrix}$$

$$\phi_\ell^J = \begin{bmatrix} \phi_1^1 & \phi_1^2 \cdots\cdots & \phi_1^{10} \\ \phi_2^1 & \phi_2^2 \cdots\cdots & \phi_2^{10} \\ \vdots & \vdots \quad \ddots & \vdots \\ \phi_{32}^1 & \phi_{32}^2 \cdots\cdots & \phi_{32}^{10} \end{bmatrix}$$

$$\lambda_d = \begin{bmatrix} \lambda_6 \\ \lambda_2 \\ \vdots \\ \lambda_{32} \end{bmatrix} \qquad \lambda_\ell = \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \vdots \\ \lambda_{32} \end{bmatrix} \qquad u_i = \begin{bmatrix} u_6 \\ \vdots \\ u_{32} \end{bmatrix}$$

sense that some of the variables described by the model appear both as independent and dependent variables. In other words, ϕ_i^J and ϕ_ℓ^J will appear simultaneously as dependent and independent variables in the system of equations. Consequently, assumption three of the linear multiple regression model, $E(X,u) = 0$, is no longer valid. Therefore, the application of ordinary least squares to equation (2) will yield biased and inconsistent estimates of the attraction coefficients. The bias will persist even for infinitely large samples.[1] A brief

[1] J. Johnston, op. cit., p.343.

algebraic explanation as to how the bias originates follows:

Our reduced model is defined as:[1]

$$\phi_i^J = \lambda_d \gamma_i^J + \lambda_\ell \phi_\ell^J + u_i \qquad (3)$$

But

$$\phi_\ell^J = \lambda_d \gamma^J + \lambda_i \phi_i^J + u_\ell \qquad (4)$$

Substituting equation (3) in equation (4) we obtain:

$$\phi_\ell^J = \lambda_d + \lambda_i \left[(\lambda_d \gamma_i^J + \lambda_\ell \phi_\ell^J) \right] + u^*$$

where $u^* = u_i + u_\ell$

or

$$\phi_\ell^J = \frac{\lambda_d}{1-\lambda_i \lambda_\ell} (\gamma_\ell^J + \lambda_i \gamma_i^J) + \frac{1}{1-\lambda_i \lambda_\ell} u^* \qquad (5)$$

Therefore, ϕ_ℓ^J is correlated with the disturbance term u_i by $\frac{1}{1-\lambda_i \lambda_\ell}$. Hence, ordinary least squares estimates tend to be upward biased.

The application of two-stage least square method suggested by Theil, among others,[2] will eliminate the correlation problem between the endogeneous explanatory variables and the disturbance term, so that the direct application of classical least squares will result in consistent estimates. (It should be noted that the biased property is eliminated only with large samples. In small samples it still persists.)

[1] The reduced model introduced here corresponds to equation (19) developed in chapter three of this study.

[2] H. Theil, "Estimation & Simultaneous Correlation in Complete Equation Systems". The Hague, Central Panbureau, 1953.

However, the application of two-stage least square for estimating the attraction coefficients remains unsatisfactory for two reasons. First, the two-stage least square will not eliminate the biased properties of the estimators for small samples. If a small sample is used, as in our case, the regression estimates will still be biased. Secondly, it was observed earlier that the covariance of the estimated residuals across equations is not zero. This implies that the second assumption of the linear multiple regression model, $E(uu') = \tilde{0}^2 I_u$ is not valid. The violation of this assumption is referred to as "heteroscedasticity." The problem which it engenders is not the biasness of the estimated regression coefficients, but that of efficiency. In other words, the variance of the estimated regression coefficients will be over-estimated. Consequently, the estimated coefficients obtained from the application of either the classical or the two-stage least square are no longer "best".[1] To obtain both unbiased coefficient estimates and unbiased estimates of the variance of the regression coefficient, Zellner and Theil have proposed three-stage least square as an estimation method.[2] The method is basically an extension to simultaneous equation systems of the Zellner treatment of groups of seemingly unrelated regression equations, or the generalized least squares method of estimation.[3]

1 Teh-Wei Hu, Econometrics, University Park Press, 1972, pp.82-85.

2 A. Zellner & H. Theil, "Three-Stage, Least-Squares: Simultaneous Estimation of Simultaneous Equations", Econometrica, Vol. 30, pp.54-78, January 1962.

3 H. Johnston, op. cit., pp.395-98.

3 - The Results of the Regression Analysis

The results of the multiple regression analysis are shown in Table 5.1. The sum of the attraction coefficients (λ_d and λ_ℓ) in each of the equations, complying with the requirement of the theoretical model, equal unity. This has been accomplished by subjecting the attraction coefficients to inequality constraints. The estimation procedure, under these conditions, is known as "mixed estimation", introduced by Theil and Goldberger.[1]

As shown by column 5 of Table 5.1, the attraction coefficients have been estimated by using O.L.S. and 3SLS estimation procedures. However, for reasons explained earlier, O.L.S. estimates should be regarded as a first attempt in the estimation of the attraction model. The more reliable estimate of the attraction coefficients, as pointed out earlier, is provided by the 3SLS method of estimation.

The value of the estimated coefficients λ_d and λ_ℓ, indicate, inter alia, the extent to which the two locational requirements, viz. demand and/or intermediate supply pertaining to any industry i, will influence its regional location pattern. Thus, λ_d and λ_ℓ are intended to reflect the weight, in terms of communication costs, which an industry associates with its demand and the supply of its intermediate inputs, respectively. It follows then that a value of λ_d close to unity implies that communication costs associated with exporting one unit of industry i's output are excessively high. The

[1] H. Theil and A.S. Goldberger, "On Pure and Mixed Statistical Estimation in Economics", International Economic Review, Vol. 2, January 1961, pp.65-78.

attempt to avoid these excessive spatial costs leads industry i to locate close to its market centres and, consequently, to produce a level of output geared to satisfy local demand. Therefore, industries whose λ_d is very high are categorized as market-oriented. It implies, within our framework of analysis, that the provincial production of industry i corresponds closely to the provincial distribution of its demand. In the opposite case, where λ_ℓ is close to unity, our analysis implies that the spatial costs of production associated with importing one unit of the intermediate input ℓ are excessively high. It follows then that industry i will attempt to avoid these excessive costs by seeking a production location close to its input source. Such industries are categorized as supply-oriented. In terms of the present analysis, it implies that industry i's provincial production pattern corresponds closely to the inter-provincial distribution of production of the intermediate input ℓ.[1]

The above discussion leads to the conclusion that the degree of industry's orientation to its demand and supply parameters is directly proportional to the value of the attraction coefficients; a value of $\lambda_d = 1$ implies complete demand-orientation, while a value of $\lambda_\ell = 1$ implies complete supply-orientation. Values of λ's in between 0 and 1 define intermediate degrees of industry orientation.

[1] A more detailed explanation of the attraction coefficients is presented in chapter three of this study.

TABLE 5.1 EXPLANATORY VARIABLES AND THEIR CHARACTERISTICS

(1) INDUSTRIES	(2) DEPENDENT VARIABLES (ϕ_i^J)	(3) REGIONAL DOMESTIC DEMAND (γ_i^J)	(4) SUPPLYING INDUSTRY (ϕ_ℓ^J)	(5) ESTIMATED ATTRACTION COEFFICIENTS λ_d OLS	λ_d 3SLS	λ_ℓ OLS	λ_ℓ 3SLS	(6) $\bar{R}^2$	(7) INDUSTRY ORIENTATION
6 MEAT PRODUCTS	ϕ_6^J	γ_6^J	AGRICULTURE	0.67 (5.39)	0.61 (9.32)	0.33 (2.34)	0.39 (5.89)	0.90	DEMAND ORIENTED
7 DAIRY PRODUCTS	ϕ_7^J	γ_7^J	AGRICULTURE	0.93 (9.80)	0.94 (15.60)	0.07 (0.65)	0.06 (1.04)	0.91	DEMAND ORIENTED
8 FISH PRODUCTS	ϕ_8^J	γ_8^J	FISHING AND TRAPPING	0	0.03 (0.89)	1.00 (15.28)	0.97 (26.41)	0.92	SUPPLY ORIENTED
9 GRAIN MILL	ϕ_9^J	γ_9^J	AGRICULTURE	0.83 (14.70)	0.85 (29.09)	0.17 (4.00)	0.15 (5.00)	0.96	DEMAND ORIENTED
10 FOOD & SOFT DRINK	ϕ_{10}^J	γ_{10}^J	AGRICULTURE	0.96 (12.13)	0.92 (12.36)	0.04 (0.65)	0.08 (1.09)	0.92	DEMAND ORIENTED
11 ALCOHOLIC BEVERAGE	ϕ_{11}^J	γ_{11}^J	PULP & PAPER	0.71 (7.29)	0.75 (27.31)	0.29 (4.55)	0.25 (9.27)	0.90	DEMAND ORIENTED
12 TOBACCO	ϕ_{12}^J	γ_{12}^J	AGRICULTURE	0.97 (7.59)	0.99 (77.59)	0.03 (2.19)	0.01 (0.47)	0.73	FOOTLOOSE
13 RUBBER	ϕ_{13}^J	γ_{13}^J	INDUSTRIAL CHEMICALS	0.22 (2.15)	0.15 (0.78)	0.78 (6.54)	0.85 (4.49)	0.78	FOOTLOOSE
14 LEATHER	ϕ_{14}^J	γ_{14}^J	RUBBER	0.69 (8.24)	0.68 (9.46)	0.31 (5.30)	0.32 (4.48)	0.79	FOOTLOOSE

TABLE 5.1 EXPLANATORY VARIABLES AND THEIR CHARACTERISTICS

(1) INDUSTRIES	(2) DEPENDENT VARIABLES (ϕ_i^J)	(3) REGIONAL DOMESTIC DEMAND (γ_i^J)	(4) SUPPLYING INDUSTRY (ϕ_ℓ^J)	(5) ESTIMATED ATTRACTION COEFFICIENTS λ_d OLS	λ_d 3SLS	λ_ℓ OLS	λ_ℓ 3SLS	(6) $\bar{R}^2$	(7) INDUSTRY ORIENTATION
15 TEXTILE	ϕ_{15}^J	γ_{15}^J	INDUSTRIAL CHEMICAL	0.88 (9.77)	0.80 (5.13)	0.12 (2.01)	0.20 (2.84)	0.88	DEMAND ORIENTED
16 CLOTHING MANUF.	ϕ_{16}^J	γ_{16}^J	TEXTILE	0.31 (2.32)	0.31 (14.35)	0.69 (5.67)	0.69 (31.52)	0.84	FOOTLOOSE
17 WOOD	ϕ_{17}^J	γ_{17}^J	FORESTRY	0.15 (2.45)	0.12 (1.47)	0.85 (9.26)	0.88 (10.81)	0.93	SUPPLY ORIENTED
18 FURNITURE MANUF.	ϕ_{18}^J	γ_{18}^J	WOOD	0.97 (13.52)	1.00 (53.80)	0.03 (5.52)	0	0.94	DEMAND ORIENTED
19 PULP & PAPER	ϕ_{19}^J	γ_{19}^J	FORESTRY	0.27 (4.23)	0.28 (7.07)	0.73 (11.19)	0.72 (17.81)	0.95	SUPPLY ORIENTED
20 PRINTING & PUBL.	ϕ_{20}^J	γ_{20}^J	PULP & PAPER	0.97 (8.69)	0.98 (30.60)	0.03 (0.94)	0.02 (0.51)	0.96	DEMAND ORIENTED
21 IRON & STEEL	ϕ_{21}^J	γ_{21}^J	MINING	0.91 (2.74)	0.93 (7.72)	0.09 (1.46)	0.07 (0.84)	0.93	DEMAND ORIENTED
22 NON FERROUS METAL	ϕ_{22}^J	γ_{22}^J	MINING	0.54 (5.93)	0.53 (9.12)	0.46 (4.31)	0.47 (8.09)	0.93	BALANCED
23 METAL FABRICATING	ϕ_{23}^J	γ_{23}^J	IRON & STEEL	0.92 (13.55)	1.00 (46.16)	0.08 (1.35)	0	0.99	DEMAND ORIENTED

TABLE 5.1 EXPLANATORY VARIABLES AND THEIR CHARACTERISTICS

(1) INDUSTRIES	(2) DEPENDENT VARIABLES (ϕ_i^J)	(3) REGIONAL DOMESTIC DEMAND (γ_i^J)	(4) SUPPLYING INDUSTRY (ϕ_ℓ^J)	(5) ESTIMATED ATTRACTION COEFFICIENTS λ_d OLS	λ_d 3SLS	λ_ℓ OLS	λ_ℓ 3SLS	(6) $\bar{R}^2$	(7) INDUSTRY ORIENTATION
24 MACHINE	ϕ_{24}^J	γ_{24}^J	METAL FABRICATING	0.22 (6.47)	0.35 (6.69)	0.78 (9.56)	0.65 (12.37)	0.93	SUPPLY ORIENTED
25 MOTOR VEHICLE	ϕ_{25}^J	γ_{25}^J	IRON & STEEL	0.12 (2.50)	0.27 (4.15)	0.88 (6.63)	0.73 (10.96)	0.97	SUPPLY ORIENTED
26 TRANSPORTATION EQUIPMENT	ϕ_{26}^J	γ_{26}^J	METAL FABRICATING	0.69 (5.99)	0.75 (28.57)	0.31 (1.53)	0.25 (4.67)	0.75	FOOTLOOSE
27 ELECTRICAL PRODUCTS	ϕ_{27}^J	γ_{27}^J	NON FERROUS METAL	0.80 (16.81)	0.77 (11.86)	0.20 (7.92)	0.23 (3.47)	0.97	DEMAND ORIENTED
28 NON METALLIC MINERAL PRODUCTS	ϕ_{28}^J	γ_{28}^J	MINING	0.69 (14.67)	0.77 (15.16)	0.31 (6.37)	0.23 (4.55)	0.97	DEMAND ORIENTED
29 PETROLEUM & COAL PRODUCTS	ϕ_{29}^J	γ_{29}^J	PETROLEUM & GAS WELLS	0.91 (19.98)	0.96 (10.29)	0.09 (0.75)	0.04 (0.38)	0.94	DEMAND ORIENTED
30 INDUSTRIAL CHEMICALS	ϕ_{30}^J	γ_{30}^J	MINING	0.91 (7.19)	0.95 (11.50)	0.09 (1.62)	0.05 (0.55)	0.88	DEMAND ORIENTED
31 CHEMICAL PRODUCTS	ϕ_{31}^J	γ_{31}^J	INDUSTRIAL CHEMICALS	0.44 (9.33)	0.27 (2.36)	0.56 (8.95)	0.73 (6.47)	0.73	SUPPLY ORIENTED
32 MISCELLANEOUS MANUFACTURING	ϕ_{32}^J	γ_{32}^J	CHEMICAL PRODUCTS	0.31 (7.51)	0.37 (8.56)	0.69 (10.28)	0.63 (14.55)	0.96	SUPPLY ORIENTED

The multiple correlation coefficient (R^2) reported in column 6 of Table 5.1 indicates the relevance of the attraction model applied to each manufacturing industry. In other words, it reflects the extent to which the inter-industry relation framework is relevant in determining each industry's inter-provincial locational patterns. Also, since the attraction model originated from backward and forward linkages, we expect the R^2 for each equation associated with a given industry to be very high, i.e. close to unity. Accordingly, an $R^2 < 0.85$ has been adopted to classify the model as inadequate in determining the industry's inter-provincial location behavior; that is, an industry whose estimation equation yields an R^2 of less than 0.85 reflects the particular industry to be footloose with respect to the hypothesized locational factors.

The results of the regression analysis, shown in Table 5.1, indicate five industries as footloose, namely the Tobacco industry; the Leather industry; the Rubber industry; the Clothing Manufacturing industry; and the Transportation Equipment industry. The remaining industries emerge as either demand- or supply-oriented, as shown in column 7 of Table 5.1. The exception to this is the Non-Ferrous Metal industry which was classified as "balanced" in the sense that both locational factors are equally relevant in determining the industry's locational behavior. This case is distinguished from the normal case where industries, in seeking a production location, will reveal a preference to locate either close to its consuming centres or close to its supply sources.

The inter-provincial production patterns of Canadian Manufacturing industries, as identified by the estimated attraction coefficients, seem to confirm our earlier hypothesis regarding the locational role of communication (or spatial production) costs. This hypothesis, it is recalled, states that for simple and homogeneous products, such as mining, communication costs associated with their distribution are usually minimal and closely correspond to transportation costs. On the other hand, products embodying diverse technology, such as banking and engineering products, whose spatial production becomes intricate and often requires an easy flow of communication between producers of related production activity as well as between producers and consumers, communication costs tend to be large. The close proximity of the various economic units usually promotes an easy communication flow. Conversely, distance between them inhibits this process. As a result, communication costs associated with the distribution of such products usually increase over distance in a prohibitive way.[1]

Accordingly, the estimated attraction coefficients associated with the distribution of simply structured and homogeneous products are in general found to be relatively low. As a result, manufacturing industries using such products as basic intermediate inputs are almost invariably found to be demand-oriented, reflecting a higher communication cost for distribution of final products. Our analysis of Canadian manufacturing industries reveals that industries manufacturing meat products, dairy products, grains, food and

1. For further details of these concepts the reader should consult chapter two and three of this study.

soft drinks, which use agricultural products as basic intermediate inputs, are invariably demand-oriented. The only exception to this is the Tobacco industry whose final product is, as well, simple and homogeneous, as Agricultural Products, indicating thereby that both final and intermediate products related to the Tobacco industry can be distributed over long distances at minimal costs. As previously explained, such distributional patterns are identified with a footloose industry.

A similar production pattern is identified for industries using Mining products as their basic intermediate inputs; Canadian Manufacturing industries in the Non-Metallic Minerals, Chemicals and the Iron and Steel sectors, using Mining products as basic intermediate inputs are, as well, determined to be demand-oriented. The exception to this is the Non-Ferrous Metals industry; although it uses Mining products as basic intermediate input, its demand attraction coefficient (λ_d) is not sufficiently high to identify the industry as demand-oriented. In fact, both attraction coefficients are approximately equal - a situation corresponding to our previous definition of a balanced industry.

Conversely, industries using bulky products as basic intermediate inputs are invariably found to be supply-oriented. In other words, although distribution of such products can adequately be reflected in terms of transportation costs alone, the bulkiness of these products makes it economically infeasible to transport them over long distances. As a result, Canadian industries manufacturing wood, pulp and paper which use forestry products as basic intermediate inputs, are invariably found to locate close to their supply sources.

A similar production pattern is observed for industries using live sea products to produce manufactured goods such as canned products. Such industries are invariably highly supply-oriented. This reflects the disproportionately high costs of distribution, arising from spoilage and contamination of such products over long distances. Consequently, the Fish Products industry, using Fishing and Trapping products as basic intermediate inputs, is determined, by the estimated attraction coefficients, to be highly supply-oriented.

The spatial production pattern of the remaining manufacturing industries, using non-primary or other manufacturing products as their basic intermediate inputs, tend to be influenced by the spatial production pattern of their supplying industries. In other words, supplying industries whose production pattern is determined to have a market orientation will, in turn, influence the production pattern of the purchasing industries to have a supply orientation. And conversely, supplying industries with a supply orientation will influence the spatial production patterns of the purchasing industries to be demand-oriented.

The rationale for the above conclusions arises directly from the development of our theoretical structure of spatial production, that is, a given industry which is found to be highly demand-oriented indicates that communication costs associated with the distribution of its final output are unusually high, while a highly supply-oriented industry indicates relatively low communication costs associated with the distribution of its final output.

It then follows that since a proportion of these industries' final output is used as intermediate goods in the final production of other industries, we should observe similar spatial costs to occur with its distribution as intermediate inputs. Accordingly, manufacturing industries whose supplying industry is highly demand-oriented will induce its purchasing industry to have a supply orientation. The opposite holds for supplying industries which are supply-oriented, that is, their purchasing industry will be induced to have a demand orientation.

The exception to the foregoing spatial framework of production constitutes purchasing industries that have a weak backward link with their supplying industries, i.e., a small $\beta_{\ell i}$. In addition to those industries whose spatial production pattern is, as well, strongly related to consumption patterns. This latter case, corresponding to our previous definition of a balanced industry, while the former case reflects our earlier conclusions that a low value of $\beta_{\ell i}$ will induce the supply attraction coefficients, as well, to be relatively low. Indicating, thereby, that either the purchasing industry will have a market orientation, reflecting spatial production patterns to be identified with regional consumption of final goods, or, in the absence of this, the industry will be determined to be footloose.

The inter-provincial production pattern of Canadian manufacturing industries, indicated by the regression results of Table 5.1, identifies closely with the above postulations of spatial production patterns. This is reflected in the supply orientation of industries such as: the Rubber industry, the Machine industry, the Motor Vehicle industry and the Chemical Products industry, purchasing basic inter-

mediate inputs from industries which are determined to be demand-oriented.

On the other hand, the Clothing Manufacturing industry and the Transportation Equipment industry, even though both buying intermediate products from demand-oriented industries, are, nonetheless, determined to be footloose. Such findings are explained by the industries' simultaneously weak backward and forward linkages. The former are indicated by the relatively low technical coefficient; $\beta_{\ell i}$ = 0.049 for the Clothing Manufacturing industry, $\beta_{\ell i}$ = 0.053 for the Transportation Equipment industry. The latter are reflected, but not uniquely identified, through the relatively low R^2 associated with the estimated equation for the individual industry.

Alternatively, the Textile industry and the Metal Fabricating industry, although purchasing intermediate products from supplying industries which are found to have a market orientation, appear as demand-oriented. These findings, at least, for the Textile industry, confirm the previously outlined rationale of spatial production; that is, since the Textile industry's technical coefficient has a relatively low value equal to 0.03, it indicates a low supply attraction coefficient for the Textile industry. This is contrary to the industry's relatively strong forward linkage, indicated by the close correspondence between the industry's inter-provincial production and the corresponding consumption patterns. Conversely, although the Metal Fabricating industry has a relatively high technical coefficient equivalent to 0.18, the industry is still found to be highly demand-oriented. This is presumably explained by the industry's strong relationship between its production and consumption

patterns which seemingly suppress the industry's possible supply attraction.

The opposite pattern of spatial production is identified with manufacturing industries such as: the Alcoholic Beverage industry, the Furniture Manufacturing industry, and the Printing and Publishing industry, buying intermediate products from supplying industries which have a supply orientation; that is, the spatial framework of production identified with such industries confirms the previously explained pattern of production. Accordingly, these industries are determined by the regression analysis to be demand-oriented.

We have, thus far, determined the estimated attraction coefficients. And we were able, on the basis of their value, to confirm the underlying rationale of industrial location. This, however, by itself, does not constitute adequate knowledge to implement a regional industrialization policy. We need, in addition, to know the region's relevant economic structure to determine whether it can successfully compete with other regions in attracting industrial resources. Policy conclusions of this nature will be arrived at by comparing the region's economic structure with their estimated locational factors. In this way, each region will be able to identify the type of industries susceptible to a viable growth within the prevailing economic environment. A regional industrialization policy can, therefore, be implemented with the objective of attracting those industries for which the given region contains an optimal location environment.

The next chapter will be devoted to the question of determining the appropriate industries to be attracted by a regional

industrialization policy.

CHAPTER VI

THE SIGNIFICANCE OF THE RESULTS FOR CANADIAN PROVINCIAL INDUSTRIALIZATION POLICY

1 - Introduction

We have thus far examined the question as to which of the two locational requirements, the industry's final demand or its use of intermediate inputs, is relatively more important in determining the inter-provincial location pattern for Canadian-Manufacturing industries. The empirical results of the analysis presented in the last chapter has permitted us to categorize industries in terms of their market or input orientation. It remains to demonstrate how these findings, together with other relevant information, can be used by each province of Canada to promote a coherent industrialization policy.

The delineation of a coherent provincial industrialization policy within the framework of the present analysis involves a comparison of each province's economic structure with the macro locational requirements identified by this study with the objective of determining the potential industries likely to have a viable growth within the existing economic environment. In the case of the lesser developed provinces, a correct policy exercise will be to ascribe to each a viable industrial base which will enhance the province's potential in attracting industries.

Thus, in general for demand-oriented industries, the most significant locational requirement comprises the existence of consuming centres; it follows that its presence (or absence) within the province's economic structure will largely determine the extent to which industries will be able to grow and to be attracted by a provincial industrialization policy. Similarly, with supply-oriented industries which are found to locate close to their supply sources, it follows that the province's endowments of these sources will determine the extent to which the individual industry will be able to grow. In fact, the successful outcome of provincial industrialization policy will largely depend on the extent to which the province's economic structure can fulfill the industries' locational need.

It is the purpose of this chapter to determine in a broad framework the type of industries that can be successfully attracted by each province. However, before we embark on the analysis of provincial industrial promotion, we shall give a brief account of the recent Canadian attempts at regional industrialization policies.

2 - Regional Industrialization Policies in Canada

During the late 1950's there appeared to be a strong incentive in Canada to give assistance to backward provinces or provinces characterized by high unemployment rates and low per capita income. Consequently, a number of agencies, both federal and provincial, emerged from this consciousness of regional development. At the provincial level agencies like the Manitoba Development Fund, and Nova Scotia's Industrial Estate Ltd were created and endowed to

borrow large sums of money for assistance programs.[1]

At the federal level a number of assistance programs were introduced such as the Agricultural Rehabilitation & Development Act (ARDA), the Fund for Regional Economic Development (FRED), the Area Development Agency (ADA), the Atlantic Development Board (ABD) and the Department of Regional Economic Expansion (DREE).

During the 60's these agencies went into full-scale operation whereby billions of dollars of public funds were spent by both federal and provincial governments in an attempt to persuade entrepreneurs to build industrial plants in provinces in which they would not normally locate. Fish plants were built in the Atlantic provinces, and Pulp & Paper plants in the Northern Prairies. A chemical plant in underdeveloped Manitoba established a strong subsidiary in underdeveloped New-Brunswick. An electronic firm moved from Ontario to qualify for assistance in Nova Scotia. A small non-viable shipyard moved from New-Brunswick, one province with high unemployment to another, Prince Edward Island.[2]

To the extent that regional industrialization policies in Canada did influence a number of industries to locate in the underdeveloped parts of Canada, the assistance programs must be categorized, at least, as a partial success. However, judging from the extent to which such policies provided a viable economic base to foster future

[1] For a more detailed discussion concerning the functions of these agencies see T.N. Brewis, Regional Economic Policies in Canada, The Macmillan Company of Canada, 1969.

[2] Philip Mathias, "Forced Growth: Government Involvement in Industrial Development", in Economics Canada: Selected Readings, edited by B.S. Keirstead et al., Macmillan of Canada, 1974.

economic growth to underdeveloped regions, the policies proved to be largely a failure. The main reason seems to be in the failure to understand that it is not sufficient simply to give assistance to any type of industries which will locate in designated regions. One must, in addition, have a factual evaluation of the industry's prospect of growth in that region; otherwise the industry will perpetually need public funds for its survival and the region will never reach a level of self-sustained economic growth.

In a period of approximately thirteen years of provincial industrial promotion, the assistance programs have induced only insignificant changes in unemployment rates and per capita income of the less developed regions of Canada. For example, in 1960 the Atlantic provinces had a per capita income of 64 per cent of the national average, Quebec 87 per cent, Ontario 118 per cent, the Prairie provinces 96 per cent and British Columbia 115 per cent. In 1973, the per capita income of the Atlantic provinces constituted 71 per cent of the Canadian average, Quebec 90 per cent, Ontario 114 per cent, the Prairie provinces 96 per cent and British Columbia 108 per cent.

The unemployment rates show approximately the same trend between the two periods. In 1960 the Atlantic provinces had an unemployment rate of 10.7 per cent, Quebec 9.1 per cent, Ontario 5.4 per cent, the Prairie provinces 4.2 per cent and British Columbia 8.5 per cent. In 1973 the unemployment rates for the Atlantic provinces constituted 9.6 per cent, Quebec 7.4 per cent, Ontario 4 per cent, the Prairie provinces 3.83 per cent and British Columbia 6.5 per cent.

Thus, in thirteen years, the attempt to industrialize less developed regions has not induced significant changes in inter-provincial allocation of industrial resources. The Atlantic provinces still remain the backward regions of Canada in terms of per capita income and unemployment rates, even though both indicators improved slightly during the period. Nevertheless, the per capita income gap between the lesser developed Atlantic provinces and the more developed Ontario and British Columbia provinces has not diminished to any significant extent and continues to remain a challenge for future regional industrialization policies in Canada.

In the following sections we propose to analyze each of the twenty-seven manufacturing industries with a view to determine the degree of attraction exerted by each province of Canada toward industrial location within its borders. However, in pursuing this analysis of industry attraction, we should keep in mind that in most cases, the three more industrialized provinces: Ontario, Quebec and British Columbia, will exert a greater degree of industry attraction than other provinces. This is simply a reflection of the fact that they are endowed with a more diversified industrial structure. Thus, it follows that a meaningful attraction analysis should make an attempt to determine the possibilities of industrial location in the lesser developed provinces without endangering the industries' growth pattern.

3 - Attraction Analysis for Demand and Supply-Oriented Industries

The estimation of the attraction model in the previous chapter has shown that twelve manufacturing industries can be categorized

as demand or market-oriented industries. Demand-oriented industries imply that a relatively high spatial or communication cost of production is incurred in the distribution of the industry's final output while the spatial costs of movement associated with the industry's basic intermediate input is of lesser importance. Consequently, the attempt by demand-oriented industries to minimize their spatial costs of production leads them to locate close to consuming centres.

Given this market-oriented locational behaviour, it is clear that a province wishing to pursue the attraction of demand-oriented industries must, at least, ascertain whether its economic structure fulfills the industries' "need" of its basic locational requirements. In other words, the successful outcome of provincial attraction policies for market-oriented industries will largely depend on the extent to which the province's economic environment provides the industries with its basic locational requirement. Each province must ascertain that its economic structure is endowed with actual or potential agglomerations of consumption of the industries' final output.

The opposite holds for supply-oriented industries. Input-oriented industries imply that a relatively higher spatial or communication costs are incurred in the movement of the industry's basic intermediate input, while the corresponding costs for the distribution of final output are of lesser importance. It then follows that such industries prefer to locate close to their supply sources. This, in turn, implies that a province wishing to pursue the attraction of supply-oriented industries must ascertain that its economic structure is endowed with undepleted sources of the industry's basic intermediate input.

The analysis which follows attempts to determine the extent to which each province can provide the individual industry with an optimum locational environment. In this way, an industrial policy can be designed for attracting those industries in which a given province possesses a comparative locational advantage. The fulfillment of this task involves a comparison of the province's economic structure of the individual industry, presented in chapter five, with its relevant locational requirements which we determined in chapter six of this study. For example, the results of the regression analysis indicated that the Dairy Products industry is highly demand oriented, implying a production location close to consuming centres. Accordingly, a province wishing to pursue the attraction of the Dairy Products industry must ascertain whether or not its economic structure fulfills the industry's locational need. The extent to which the province fulfills this locational need will determine the successful outcome of an industrial policy pursuing the attraction of the Dairy Products industry.

Among Canadian provinces, British Columbia and Manitoba seem to fulfill the Dairy Products industry's locational need more adequately than any other Canadian province; that is, each province imports approximately 33 per cent and 24 per cent of its consuming need. This, in itself, indicates that the respective provinces' economic structure is endowed with relatively undepleted sources of the industry's basic locational requirement, and can, hence, provide a locational environment conducive to the industry's growth.

As to other provinces, they either reflect an export capacity of Dairy Products indicating a depletion of the industry's demand in home markets or a small share of the industry's national consumption taking place within their borders. Both of these factors suggest adverse locational conditions mitigating against industry's growth potential in these provinces.

Results of the attraction analysis similar to the one described in the above paragraph, for each of the twenty seven manufacturing industries are shown in Table 8.1. The Roman numerals reflect the ordinal strength of the relative locational advantages provided by each Canadian province for the respective industry. For example, Roman numeral I is intended to reflect the fact that a province can adequately fulfill the industry's major locational need. The Roman numeral II signifies that the province can adequately fulfill the industry's need of its major locational requirement, but does not adequately fulfill the industry's need of its lesser important locational requirement. The Roman numeral III reflects that the province can adequately fulfill the industry's need of the lesser important locational requirement, but cannot fulfill the industry's need of its major locational requirement. The Roman numeral IV shows that the province cannot fulfill either of the industry's locational requirements, but has a relatively good access to them in other provinces. The Roman numeral V reflects the worst possible situation; that is, the province cannot fulfill the industry's locational need, and in addition it has a poor access to them in other provinces.

The locational environment described by II occurs whenever neither attraction coefficient is close to unity, but none of them exceeds 0.5. This indicates that although the industry will have a preference to locate closer to either its consuming centres or to its supply sources, depending on which of the λ's is higher, nevertheless the lesser important locational requirement is also relevant, and hence it should also be considered by the industry seeking a production location. Hence, the locational environment described by II, although it reflects the province's endowments of the industry's basic location requirement, it does not provide the industry with sufficient supply of its second locational factor. The locational environment described by III points to an even worse locational environment where the province can only satisfy the industry's need of its lesser important locational requirement. The locational environment described by IV occurs whenever the value of the attraction coefficient are relatively low, i.e. close to 0.5, indicating that although the province's economic structure cannot fulfill the industry's locational need, the relatively low spatial costs of production will nevertheless permit the industry to satisfy its locational need from other provinces. The locational environment described by numeral V reflects the worst possible locational environment. It occurs whenever the value of an attraction coefficient is close to unity. Thus indicating that the spatial costs of production associated with the inter-provincial movement of the particular locational requirement is excessively high hence prohibiting the province to attain the industry's locational need from other provinces.

It follows that a coherent provincial industrialization policy should be directed to attract that set of industries for which the given province's economic structure completely fulfills their locational need, i.e. those industries identified by the numeral I. If the province cannot provide an optimal locational environment for any of the industries, it should then seek to attract those industries which are identified as the second-best alternatives, i.e. those industries identified by the numeral II. This process should be continued until the fourth best alternative is reached. Given this hierarchy, it would seem that the province should never attempt to attract that set of industries which are associated to it by the numeral V. The latter reflects poor locational conditions both at home, and poor access to the locational requirements abroad. Thus, an industrial policy which attempts to attract these industries is bound to be unsuccessful and lead to inefficient allocation of resources.

It should also be pointed out that whenever an individual province undertakes the task of attracting industries, it automatically competes with other provinces. In view of this, a provincial industrial policy directed toward attracting those industries for which the province does not have a comparative locational advantage may negate the outcome of the policy. It follows then that a province should devote its efforts in attracting industries for which it can completely fulfill their locational requirements. The exception to this general rule includes those provinces which are subject to a low level of present industrial activity, and, as well, have an expected low rate of industrial growth. These economic conditions imply that the province will not have a comparative locational advantage for any of the

industries. But, its immediate need for industrial resources will necessitate the implementation of an industrial policy involving the attraction of those industries for which the province can only partially fulfill their locational requirements.

4 - Provincial Attraction Policies for Canadian Manufacturing Industries

Table 8.1 shows that the more developed provinces, British Columbia, Ontario and Quebec, due basically to their versatile industrial structure, can fulfill the locational need for a wide range of industries. They are followed by the Prairie provinces whose economic structure show, as well, comparative locational advantages for a number of industries--the exception to this being Manitoba whose economic structure shows a locational advantage for the Dairy Products industry only. The lesser fortunate provinces in the attraction of industrial resources are the Atlantic provinces. The exception to this is Nova Scotia providing an optimal locational environment for three industries, namely the Fish Products industry, the Motor Vehicle, and the Electrical Products industries.[1] Both Newfoundland and Prince Edward Island can provide an optimal locational environment only for the Fish Products industry. And even worse off is the remaining Atlantic province - New Brunswick - which cannot completely fulfill any of the industries' locational need.

[1] The results of this analysis are derived from a given locational environment which was described in detail in the last two chapters. Although locational factors do change in a dynamic framework, we must assume their constancy in the static framework if we were to analyze a given economic structure.

In the concluding chapter, we consider possible changes when a dynamic or a comparative static framework is applied to the analysis.

INTERPROVINCIAL LOCATIONAL ADVANTAGES FOR CANADIAN MANUFACTURING INDUSTRIES

	PROVINCES / INDUSTRIES	1 NFLD	1 P.E.I.	3 NOVA SCOTIA	0 NEW BRUNSWICK	3 QUE.	6 ONT.	1 MAN.	3 SASK.	4 ALT.	12 BR. COL
	Meat Products	IV	IV	IV	IV	II	II	IV	III	III	II
	Dairy Products	V	V	V	V	V	V	I	V	V	I
	Fish Products	I	I	I	V	V	I	V	V	V	V
	Grain Mills	V	V	V	V	V	V	V	III	III	I
	Food & Soft Drink	V	V	V	V	V	V	V	I	I	I
	Alcoholic Beverage	III	IV	IV	III	III	IV	II	II	II	I
Footloose	Tobacco										
	Rubber	IV	IV	IV	IV	III	II	III	III	I	I
Footloose	Leather										
	Textile										
	Clothing Manuf.	IV	IV	IV	IV	II	III	IV	III	III	III
	Wood	V	V	V	V	V	V	V	V	V	I
	Furniture Manuf.	IV	IV	IV	IV	IV	IV	IV	II	II	I
	Pulp & Paper	V	V	V	V	V	V	V	V	V	I
	Printing & Publish.	V	V	V	V	V	V	V	I	I	I
	Iron & Steel	III	IV	III	IV	I	IV	IV	III	IV	I
	Non-Ferrous Metals	III	IV	IV	IV	IV	II	IV	III	IV	III
	Metal Fabricating	V	V	V	V	I	I	V	V	V	V
	Machinery	V	I	V	V	I	I	V	V	V	V
	Motor Vehicles	V	V	I	V	V	I	V	V	V	V
Footloose	Transportation Equip.										
	Electrical Products	III	IV	I	IV	IV	IV	II	I	II	I
	Non Metallic Mineral Prod.	V	V	V	V	V	I	V	V	V	V
	Petroleum & Coal Products	V	V	V	V	V	I	V	V	V	V
	Industrial Chemicals	III	IV	III	III	II	IV	II	III	IV	III
	Chemical Products	IV	IV	IV	IV	IV	II	III	III	I	I
Footloose	Miscellaneous Manuf.										

In view of the findings reported in Table 8.1, it is obvious that the more developed provinces show a comparative advantage in the attraction of industrial resources over the lesser developed Canadian provinces. This, in turn, indicates that they have the greater potential of future industrial growth, as well. Among these is British Columbia. Since it provides an optimal locational environment for twelve industries, it will therefore have a greater expected industrial growth than both Ontario and Quebec. In fact, the latter, since it provides an optimal locational environment for only three industries, shows indications of poor prospects of industrial growth. Hence, it may be categorized as a potentially depressed region wherein the level of present industrial activity is high, but its expected rate of industrial growth is relatively lower than the other two developed provinces.

In contrast, Alberta, and to a lesser extent Saskatchewan and Nova Scotia, having a comparative locational advantage for four and three industries respectively, show a relatively high expected rate of growth of industrial activity, and yet their present level of industrial activity is relatively low. The provinces which are worst off, in terms of the present level of industrial activity and expected rate of industrial growth, include the Atlantic provinces (with the possible exception of Nova Scotia) and Manitoba wherein both the present level of industrial activity and the expected rate of growth of industrial activity is low. Hence, we can categorize them as the "depressed" provinces.

The previous arguments have shown that unless an industrial policy is implemented with the explicit purpose of directing industrial resources to the depressed Canadian provinces, the natural tendency will be to locate production plants in the more developed provinces. There-

fore, while the growth rate of industrial activity will increase in the prosperous provinces, the opposite will occur in the less fortunate provinces. The growth rate of industrial activity in the latter may even become negative and lead eventually to complete industrial stagnation.

On the other hand, the tendency of industrial location toward the prosperous provinces, or toward existing growth centres, even if unchecked by policy, will not be a perpetual one. Eventually, the existing growth centres, as argued in chapter one, will reach a level of industrial saturation giving rise to increasing costs of production and decreasing real per capita incomes and corporate profits.[1] When that happens, an entrepreneur seeking a new production location will be confronted with inadequate location alternatives, that is, poor locational environment in both existing growth centres and in previously abandoned depressed provinces. The latter regions have additional constraints in the form of an adequate infrastructure conducive to a promotion of industrial activity. The task of building a new infrastructure in these regions, aside from the fact that it will necessitate large flows of savings which may not be available in domestic markets, will unavoidably bring about delays in the production process; and hence, unduly endangering the overall objective of national economic growth.

The continuous implementation of a coherent industrial policy will eliminate the ill effects caused by congestion of industrial activity in existing growth centres. Such a policy should embody a deliberate attempt to create possibilities of production location in new

[1] Nevertheless, as a practical matter, it is difficult to ascertain these saturation points.

locations, while simultaneously maintaining a viable national economic growth. The analytical results obtained by this study will hopefully enable the policy-makers to implement a coherent industrial policy which will fulfill the two above-mentioned objectives by directing the location of industries capable of growth to the lesser developed provinces.

The foregoing arguments have shown that the lesser developed provinces, due mostly to an inadequate industrial structure, are, in most cases, incapable of providing the individual industries with the required location need. However, Table 8.1 indicates that the lesser developed provinces can partially fulfill the locational need for a number of industries. This seems to dictate that an industrial policy should be implemented to attract those industries for which the province can, at least partially, fulfill the locational requirements. For example, New Brunswick can provide the Industrial Chemical industry and the Alcoholic Beverage industry with their second important locational requirement; while the relative low attraction coefficients for both of these industries indicate that the spatial costs of production associated with the industries' major locational requirement is relatively low. In view of this, the respective industries can, therefore, locate in some areas of New Brunswick and obtain its major location requirement from other provinces without endangering the industries' normal growth pattern.

A similar policy recommendation follows for the remaining lesser developed provinces; that is, an industrial policy should be implemented which will attract either those industries whose locational requirements are partially fulfilled by the existing economic structure

or those industries which have an easy access to their locational requirements from other provinces. The presence of each of these industries in the lesser developed provinces will, in turn, improve their industrial structure and will, in addition, provide a comparative locational advantage for those industries linked either backward or/and forward to the newly attracted industries.

5 - Attraction Analysis of Footloose Industries

Industries which are identified as "footloose" indicate that their inter-provincial production location is explained neither by the provincial distribution of demand nor by the provincial distribution of the industry's basic intermediate input. Thus, footloose industries imply that communication costs associated with the industry's demand, as well as its supply of intermediate inputs, is not an important criteria by which inter-provincial production patterns are determined, and that factors other than these will ultimately determine the industries' production location.

Within the present framework, footloose industries can be identified by either low attraction coefficients, or by a low value of its respective 't' statics, which implies that each estimated coefficient is not significantly different from zero. Or, alternatively, by a relatively low multiple correlation coefficient (R^2) which indicates that the inter-industry relations described by the attraction model do not sufficiently explain inter-provincial production location.

However, it should be observed that since the analysis has attempted to determine a relative weight in terms of communication costs

which each industry associates with its two locational requirements, it is, then, likely to obtain a value of one of the estimated coefficients to be close to unity and yet still observe that inter-provincial production patterns do not correspond to neither the industry's provincial distribution of demand nor to the provincial distribution of its basic intermediate input. In other words, a relatively high value attraction coefficient can result from the regression analysis as long as either the industry's final output or the industry's basic intermediate input is subjected to a larger inter-regional trade flow. Alternatively, we can also obtain equally low attraction coefficients, with each having a value of approximately 0.5, and yet still observe a close correspondence between the industry's inter-provincial production pattern with the industry's provincial distribution of its two locational requirements.

In the former case above, we should be able to associate the high value attraction coefficient with a low 't' value and/or with a relatively low multiple correlation coefficient. Thus, indicating that such industries can be categorized as footloose. Inversely, in the latter case, a high 't' value should be associated with each of the attraction coefficients together with a high value of the Multiple Regression coefficient. This will, in turn, appropriately indicate that both locational requirements are equally important in determining the industries whose attraction coefficient both equal to 0.5, can also be identified as being footloose. Its fulfillment requires that both, the industry's final output and the industry's basic intermediate input, are equally subjected to large inter-regional trade flows, and hence are

both equally insignificant in determining the industry's optimal locational site.

Footloose industries are of special importance to the lesser developed regions. Backward regions, as a rule, are not endowed with a versatile economic structure which constitutes a basic element in pursuing the attraction of either demand or supply-oriented industries. Instead, they are usually characterized by an antiquated or inadequate economic structure which frequently lacks the locational factors required for the attraction of these industries. However, since footloose industries are characterized by their lack of orientation toward either consuming or supply centres, it follows that their lack within a given economic structure may not necessarily be detrimental to the industry's normal growth path. In fact, location of footloose industries within the lesser developed regions may provide to the region the required impetus for it to sustain a viable economic growth.

Within the context of Canadian inter-provincial production pattern, the Tobacco, Leather, Transportation Equipment, Electrical Products and Miscellaneous Manufacturer industries can all be identified as footloose. Their low attraction coefficients, in addition to the relatively large inter-regional trade flows for both their final output and basic intermediate input, seem to suggest that communication costs associated with either of their locational requirement is not a significant factor in determining production location. The implications of these findings with respect to Canadian regional industrialization policy will be elaborated more fully in the chapter to follow.

CHAPTER VII

CONCLUSION

1 - General Remarks

In previous chapters, we have identified the basic locational factors which determine inter-provincial allocation of industrial resources. We have, in addition, indicated the provinces within which individual industries may be optimally located. Within this context, we found that the less developed provinces, viz., the Atlantic provinces, are, in most cases, unable to attract industries which have either a strong supply or demand orientation. For example, the attraction analysis of twenty-seven manufacturing industries indicates that only the Fish Products industry can optimally be located in the Atlantic provinces. In all other cases, the Atlantic provinces' economic structure fails to fulfill the industries' locational needs. At the other extreme, we found that British Columbia provides an optimal locational environment to a wide range of manufacturing industries. As a result, its industrial growth potential is higher than that of the remaining Canadian provinces.[1]

[1] Similar conclusions regarding regional industrial growth in Canada were arrived at by the Economic Council of Canada in a recent study titled "Regional Aspects of the Evolution of Canadian Employment" by Fernand Martin, 1975.

The study attempts an analysis of past trend (1961-1970), of regional industrial growth in Canada. The traditional methodology of "Shift & Share Analysis" was applied. This enabled the identification of sectors and industries in each region whose past performance was "bad" or "good" with respect to national average.

However, overall, the study is rather weak. It considers only past performances and no attempt is made to determine possible regional potential.

However, from the regression analysis we determined five industries to be footloose with respect to communication or spatial costs of production identified by this study. This implies that these industries can be located anywhere in space or in any province without necessarily violating the location behaviour with respect to minimum spatial cost criteria. It would seem appropriate, therefore, that industrial policies should be implemented in an attempt to attract footloose industries to the lesser developed provinces of Canada. A similar recommendation follows for those industries whose attraction coefficients are relatively low. Since the spatial cost of production for these industries is not of a prohibitive nature, an attempt should be made to influence such industries to locate in those provinces which have a more immediate need for additional industrial allocation of resources.

The attraction of some of the industries initially to the less developed provinces will, in turn, improve their own inter-industry relations and their economic structure, thus enhancing the provinces' influence in attracting additional industries within their political boundaries. For example, our analysis finds the Iron & Steel industry as the basic locational requirement for the Motor Vehicle industry. Thus, the attraction of the former to the Atlantic provinces will, other things being equal, impart a locational advantage for the attraction of the Motor Vehicle industry,[1] as well. The attraction of the Motor Vehicle industry, in turn, will further improve the region's economic structure and with it, locational advantages in the attraction of other industries. The process is expected to continue

[1] This conclusion rests on the assumption of equal input availability in every province, that is, if one assumes primary inputs to be equally available in every province, then the atlantic provinces will have a locational advantage for the Motor Vehicle industry.

until a mutually interacting industrial complex[1] emerges which will give the province a versatile economic structure capable of maintaining an adequate level of industrial activity and economic growth.

It is necessary, therefore, that total effects resulting from the presence of a new industry within a region in the attraction of other industries must be determined, and appropriate industrialization policies seeking to attract these mutually inter-related industries to the region must be implemented.

It should be emphasized that unless a selective industrialization policy for attracting industries to the lesser developed provinces is implemented, their natural tendency will be to locate in existing growth centres where the risk and uncertainty associated with product markets, intermediate goods, capital and skilled labour is greatly reduced. This results from the inherent belief that these resources would be available in abundant quantities in existing growth centres - an assumption which is certainly invalid for lesser developed provinces. This natural tendency of industrial location toward existing growth centres may persist even though risk averting producers may be aware of higher costs of production, resulting from the presence of congestion and external diseconomies in established growth centres. In view of this, it would seem that the successful outcome of a provincial industrialization policy depends largely on the extent

[1] For a more detailed discussion on industrial complex analysis, the reader is referred to the introductory chapters of this study, and to the classical study by Isard et al., Industrial Complex Analysis and Regional Development, M.I.T. Press, 1959.

to which local authorities are able to correct, at least partially, adverse business expectations. For example, in the case of uncertainties regarding sources of capital and skilled labour, the authorities must make these resource available to the entrepreneur. Market uncertainties, to the extent that they can be predicted, must be indicated, and appropriate subsidies depending on the type of industrialization pursued must be provided, including those covering the relocation costs.

Subsidies as an instrument of regional industrialization policy can take a variety of forms. In the present context we will elaborate on labour and capital subsidies.[1] The type of subsidy chosen will depend largely on the objective to be fulfilled. For example, if the immediate objective is to reduce regional unemployment, usually a payroll subsidy is preferred. The impact of a regional labour subsidy in reducing unemployment will depend on the rate at which capital can be substituted for labour, or simply on the marginal rate of technical substitution between labour and capital[2] (MRS).

The impact of labour subsidies will depend largely on the nature of the regional production function. For example, with the Leontief type of production function, defined in terms of fixed production coefficients, a labour subsidy will be effective only if labour is the binding constraint, i.e. only if capital is also in excess supply. In this case, it is irrelevant whether a labour or a

[1] For a more detailed discussion on regional subsidies, the reader should consult: Borts, G.H., "Criteria for Evaluation of Regional Development Programmes", ed. W.Z. Hirsh, Regional Accounts for Policy Decisions, John Hopkins Press, Baltimore, 1966.

[2] Where the Leontief production function applies the product mix can be an alternative measure, that is, shifting production from commodity i to commodity j, the latter is assumed to have a higher labour coefficient than commodity i.

capital subsidy is applied. On the other hand, if the regional production function is defined to have infinite factor elasticity, (i.e. $MRS_{L,K} = \infty$), then, a labour subsidy will have a maximum impact on reducing regional unemployment.[1]

The more usual case of a regional production function involves the Cobb-Douglas production function. With a regional Cobb-Douglas production function, a labour subsidy will always increase employment. Even then, the size of the impact on employment will depend largely on whether the regional industries are labour or capital intensive.[2]

A capital subsidy, unlike a labour subsidy, is appropriate only to fulfill the regional growth objective, defined in a long-run perspective. A capital subsidy in the short run may have an adverse effect on regional employment, if the effect of an increase in output outweighs the factor substitution effect. In other words, a capital subsidy will have a positive impact on regional output (the output effect). Other things being equal, this will, as well, have a positive effect on employment.

1 This really implies that a given production process will have an alternative to use only labour or only capital. Although this may be theoretically valid, in reality regional economies are not subjected to infinitely elastic production coefficients.

2 G. McCrone, Regional Policy in Britain, Allen & Unwin, London, 1969.

However, as discussed in the introductory chapters, a capital subsidy will benefit mostly capital-intensive industries. The outcome of this will have a minimal direct impact on employment (or even a negative impact), in the short run. In the long run, the indirect impact on output of other ancillary industries, in addition to those which may be attracted to the region, will be more beneficial to the region, not only in reducing overall unemployment, but also in fulfilling the regional growth objective.[1]

It must be emphasized that industrial policy measures must be initially directed toward attracting those industries which are either footloose or those whose spatial costs of production is relatively low. This should be followed by subsequent studies on the locational impact of initial industrialization upon the existing economic structure as well as on the attraction of complementary and mutually-linked industries. Failure to pursue a selective industrialization policy on these lines is bound to be unsuccessful, and lead to inefficient allocation of resources.

In support to the above conclusion, we can cite the case of India which in the 1950's began an industrialization policy with the objective of attracting to various areas small and mid-sized industries. It was expected that these industries would concentrate on the production of labour-intensive goods and would eliminate the existing disequilibrium arising from an excess supply of labour. Consequently, an intensive

[1] Other regional policy instruments are discussed in the introductory chapters of this study. Also, a good review of regional policy instruments is available in J.B. Stilwell, Regional Economic Policy, MacMillan Press Ltd., 1972.

program of creating Industrial Estates in those areas began. It involved the building of factory sheds, provision of water supply, electrical power, the building of transport routes and other auxiliary services. However, by the end of 1967, only 74 per cent of factory sheds were leased or sold to prospective entrepreneurs. Moreover, the eventual operation of the industries did not involve the production of consumer goods, as was originally planned. Instead, they tended to concentrate on the production of producers' or capital-intensive goods and consequently failed to eliminate the unemployment to any appreciable extent.[1]

It soon became clear that uncertainties with regard to markets for consumer goods was the basic element contributing to the Indian failure at labour-intensive industrialization. Although the program eventually proved to be successful as a means of a general industrialization policy, the fact that only 74 per cent of factory sheds were occupied nevertheless indicates that the outcome fell short of overall planned expectations.

India's experience provides a good example of a case where in the absence of appropriate studies regarding a region's locational advantages prior to the implementation of an industrialization policy, the attempt to direct industrial resources to areas whose economic structure is not conducive to the attraction of particular industries sought will be unsuccessful. Such a circumstance will unavoidably result in misallocation of national resources and eventually, to a set-back to the objective of overall national growth.

[1] Louis Lefeber, et al., Regional Development: Experiences & Prospects South and Southeast Asia. United Nations, Research Institute for Social Development, Geneva 1970; pp.207-212.

The concept of an Industrial Estate is undoubtedly of basic importance in sparking initial industrialization in lesser developed areas. More important, however, is the condition that prior to the establishment of industrial estates, the area concerned must select industries to be sought on the basis of efficiency criteria or on the basis of the industries' prospects of growth within the existing economic structure. The mere building of factory sheds with provision of auxiliary services will not by itself ensure a successful outcome of an industrialization policy.

2 - Limitation of the Method

The limitation of the method of industrial location proposed in this thesis arises mostly from dynamic considerations. In other words, the present method restricts attention to given structural parameters and does not attempt at an analysis of locational factors in the distant future. Consideration of future locational patterns requires the introduction of time in a systematic manner, and its effect on the relevant locational factors. While the element of time can be easily integrated in a behavioral model, its effect on locational factors will have to emerge from a subjective evaluation; which, among other things, will have to predict the extent to which locational factors will change through time. A fully dynamic approach will enable one in making long-run forecast of locational factors. However, in view of its inherent limitations, this approach will be useful to the extent which motivates interest and awareness that locational factors, like most other things, will change with time.

Historical locational factors, such as transportation networks, have been significant in the past in developing existing growth centres and urban-industrial agglomeration. This type of nodal development in itself has contributed toward the attraction of additional industries, inducing further economic growth in the centre and in the regions where growth centres exist. Thus, existing spatial production patterns have evolved through a complex process of interaction where the "transport" variable played a significant role. However, cumulative developments in the field of production and transport technology have tended to lessen the importance of transport variable as a significant factor in production location.[1]

Despite the lesser significance of transportation variables, agglomeration economies, generated from past production location, are still a relevant and significant factor in spatial production. This study has been concerned, inter alia, with the basic question of how growth centres can be artificially created in lesser developed Canadian provinces. The concern partly arose from congested agglomeration in existing growth centres and the negative effects, originating from it, on regional economic growth.[2] The analytical approach, proposed by this study, will prove to be a useful tool of analysis toward the fulfillment of this task. Firstly, it will enable policy makers to classify industries in terms of market or supply orientation.

[1] See chapter two of this study for a more detailed discussion on this point.

[2] See chapter one for further developments on this issue.

Secondly, it will throw light on the question of proper assignment of industries capable of growth in individual Canadian provinces.

It should be observed that the conclusions derived in this study with regard to the attraction of industries rest fundamentally on individual provinces' endowment of excess demand and supply of final and intermediate goods. The policy prescriptions that emerge for such an analysis assume that demand and supply conditions do not change.[1] A possible instance where this assumption must be relaxed is the presence of a new industry which will have an impact on the existing regional economic structure. As a result, the assumed constancy of the economic framework will no longer be valid. For example, the presence of a new industry in a given province will affect the existing demand and supply relationship, and the prices at which products are traded. This may disturb the equilibrium in a variety of ways. If excess demand exists initially, the effect may be desirable to the extent that the new industry will tend to equilibrate demand and supply relationship. Conversely, if an excess supply prevails, the presence of the new industry will worsen the existing regional disequilibrium.[2]

It is important, therefore, as has been pointed out throughout this study, that the probable effects resulting from the presence of a new industry must be determined prior to its attraction. Whether

[1] The assumption has been made to facilitate the task of interprovincial comparison of their ability to attract industries, and on their respective potential of industrial growth.

[2] This kind of disequilibrating effects can be avoided or minimized if selection of industry is made on the basis of empirical findings reported in this study. Also, it should be observed that the analysis follows only if imperfect competition is assumed.

the attraction of a particular industry in a particular province is desirable must be judged on the basis of an estimate of probable consequences. Such micro studies should be extended to other industries sought by a provincial industrialization policy. Their basic purpose is two-fold. Firstly, they must carefully chart the effects of the presence of the industries sought on the existing economic structure. Secondly, they must show the province's new potential in the attraction of industries. These micro studies should be undertaken on a continuous basis as an integral part of a provincial industrialization policy.

STATISTICAL

APPENDICES

STATISTICAL APPENDIX A

1 - Introduction

The objective of this statistical appendix is to derive some preliminary general conclusion about the macro-locational characteristics of Canadian industries. This is done through a detailed consideration of the input and output relationship of each industry under study. Specifically, we consider total demand for each industry's output, both as intermediate and final goods, and the industry's demand for intermediate inputs, or simply, the industry's direct requirements. Subsequently, these two separate relationships are combined to derive the industry's total need. From the latter are derived the most significant macro-locational requirements for each industry on the assumption that the industry attaches equal weights to its intermediate requirements, and to its final demand. In this way, we can determine the importance of each of the industry's locational requirements simply by comparing the respective weights.

This inquiry is carried out by using the Canadian input and output tables (40 x 40) which were obtained on request from Statistics Canada. The results of this preliminary analysis can be used by each region seeking to promote an industrialization policy, through a simple comparison of its own economic structure with the macro-locational requirements derived at the national level, and hence determine the extent to which the locational requirements of industries to be attracted by the region can be fulfilled. The successful outcome of a regional industrialization policy will depend to a large extent on whether the locational requirements for each industry sought are available within the region's economic environment.

Ideally, the inter-industry relationships should be studied for each region, and the macro-locational requirements for each of the industry should be identified with the respective region. This will avoid the implicit assumption of homogeneous inter-provincial production patterns which is inherent in using the derived macro-locational requirement at the regional level. In other words, the compatibility of the macro-locational requirements at the regional level necessarily implies that the technological environment or production patterns for each region are close substitutes or representative of national production patterns. Although the assumption may be true to a large extent for the more developed regions, it can only apply to a limited extent to less developed regions. Yet, for the latter regions, the results of the analysis prove to be of even greater significance. This is so because the purpose of embarking on an industrialization policy in the less developed regions is not simply to attract one or two industries, but preferably an entire complex of industries closely linked with each other. This will simultaneously fulfill the region's dual objective of increasing the level of technology and of promoting an industrialization policy.

2 - The Inter-Industry Requirements of the Canadian Manufacturing Industries

Table A1. shows the input requirements for Canadian manufacturing industries, that is, it indicates the contribution by each sector to the production of the respective industry's final output. The table is constructed so that the input requirements of manufacturing industries are read column wise, and the industries supplying the inputs are identified by the column titled "Industries", which if read row wise, it identifies

as well, the manufacturing industries numbered from 6 to 32. The numerals under each industry number identifies, in terms of percentages, the contribution of each industry supplying more than 2 per cent of the respective industry's gross output. Industries supplying less than 2 per cent are aggregated and identified in the table by the term "All Other Industries". It is followed by imports of intermediate inputs, and value added, or the contribution of the primary factors of production, labour and capital, to the industry's final output.

For a more detailed explanation of the information presented by Table A1., we choose, as an example, industry No. 6, corresponding to the Meat Products industry, to analyse its input structure. From Table A1., it is observed that the Meat Products industry requires 55.4 per cent, in terms of its gross output, from the Agriculture industry; that is, for every unit of the Meat Products industry's final output, 55.4 per cent is contributed by the Agricultural industry's final output.

Similarly, the Meat Products industry contributes 11.9 per cent,[1] the Trade industry 3.8 per cent; the remaining industries, referred to in the Table as "All Other Industries" contribute a total of 10.5 per cent; Imports and Value Added each contributing 3.5 per cent and 14.9 per cent respectively to the final output of the Meat Products industry.

[1] This indicates that 11.9 per cent of the Meat Products industry's gross output is used as an intermediate good for the completion of its own final output. It should be observed that this phenomena originates from the level of industry aggregation being used. A highly industry disaggregated table will, likely, not show a portion of a given industry's final output being used by the same industry as an intermediate good.

TABLE 1.A

THE INTER-INDUSTRY REQUIREMENTS FOR THE MANUFACTURING INDUSTRIES IN PERCENTAGES OF GROSS OUTPUT

No.	Industries	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Agriculture	55.4	46.5		34.4	8.9	3	26.7																				
2	Forestry												24.7		12.4													
3	Fishing + Trapping			40.2																								
4	Petroleum + Gas Wells																								35.9			
5	Mines																9.8	31.4						6.2		4.7		
6	Meat Products	11.9			2.2					4.3																		
7	Dairy Products		10.5																									
8	Fish Products			3																								
9	Grain Mills				7.3	3.7																						
10	Other Food + Soft Drink		2			10.9	4.4																				2	
11	Alcoholic Beverage																											
12	Tobacco							22.2																				
13	Rubber								2.1	3.4				2														
14	Leather									18.6																		
15	Textile								9.4	2.7	27.5	33.6		9.7														
16	Clothing Manufacturers											4.9																
17	Wood												11.2	7.8	3.2													
18	Furniture Manufacturers													2.6														
19	Pulp + Paper		3	3.2	2		3.8	3.2			2			2.2	13.6	16.5											3.2	2.6
20	Printing + Publishing															6.4												
21	Iron + Steel													2.6			10.9		18.1	6.8	4.4	5.3	2.7					
22	Non-Ferrous Metals																4.5	30.5	4.1			2.1	7.9					3.4
23	Metal Fabricating			7.2		3								5.8					9.8	7.7	4	4.6	4.6					2.9
24	Machinery																			7.5		9.5						
25	Motor Vehicles																				29.9							
26	Other Transportation Equipment																					11.5						
27	Electrical Products																			3.9	2	2.9	13.1					
28	Non-Metallic Mineral Products						2.9																	11.9				
29	Petroleum + Coal Products																								7.4			
30	Industrial Chemicals								8.4		3				2.5										2.5	10	10.8	2.1
31	Chemical Products								5.6																	2.7	8	5.2
32	Miscellaneous Manufactures									2.2		2.6		2.9														4.2
33	Construction																											
34	Transportation + Storage				2																				7.4			
35	Communication															2												
36	Utilities														2.6		2.2							2.2		4.8		
37	Trade	3.8		3.5	3.3	2.7			2.3	4.7	2.9	4	3.8	4.5	2		1.3	2.3	2	2.5	2	2	2	2.1		2.1	2.7	2.1
38	Finance, Ins. + Real Estate																											
39	Owner-Occupied Dwellings																											
40	Other Services						3																					
	All Other Industries	10.5	14.8	16.8	29.5	21.3	24.3	14.5	16.7	17.6	14.3	13.1	19	13.6	18.6	16.3	15.3	7.1	14.9	14.4	14.4	17.1	18.8	23.5	13.1	18	29.8	19.3
	Total Industry Requ.	81.6	76.8	68.9	80.7	54.7	41.4	68.6			49.7	58.1	58.7			41.2	46	75.3	48.9	42.6	58.7	48	43.1	45.9	78.9	45.8	56.5	41.8
	Imports	2.5	2.2	6.3	—	8	8.8	2.9	13.5	13.4	17.3	6.1	5.1	6.5	3.9	9.5	12.7	6.7	12.9	24	19.4	13.3	15.6	9.5	9.9	11.9	10.9	20.6
	Value Added	11.9	21	25.8	19.3	37.3	49.8	28.5	42	33.1	33	35.8	36.2	41.8	41.2	49.3	41.3	19	38.2	33.4	21.9	38.7	35.3	44.6	11.2	42.3	32.6	37.6
		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

The input requirements of subsequent Manufacturing industries, since their interpretation follows similarly as the Meat Products industry's, it follows that an individual analysis of the Manufacturing industry's input structure will be redundant. The reader interested in the individual input structure of Canadian Manufacturing industries is referred to Table A1.

3 - The Distribution of Sales of Canadian Manufacturing Industries

Alternatively, Table A2. indicates the disposal of the individual industry's gross output, that is, while Table A1. described the contribution of various sectors to produce the final output of a given industry, Table A2. describes a similar accounting identity stating how a given industry's gross output is disposed of. The disposal of final output, or the consumption of an individual industry's gross output, is shared between intermediate and final consumers. Intermediate consumers correspond to industries which use a given industry's final output for the production of other goods or services, while final consumers use their respective share for immediate consumption. Intermediate consumers are identified in Table A2. by the industry column, while their respective level of consumption of each industry's final output is given under the respective industry identified by numerals 6 to 32. Industries which consume less than 2 per cent of the individual industry's gross output are aggregated and shown by the term "All Other Industries". The share of final consumption of each industry's final output is given by the final demand sectors.

TABLE 2.A

THE DISTRIBUTION OF SALES OF THE MANUFACTURING INDUSTRIES IN

PERCENTAGE OF GROSS OUTPUT

No.	Industries	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Agriculture				46.4		2.7																		9.7	6.1	5.3	
2	Forestry																											
3	Fishing & Trapping																											
4	Petroleum & Gas Wells																											
5	Mines																								2		2	
6	Meat Products	11.9					4.2																					
7	Dairy Products		10.5				3.8																					
8	Fish Products			3																								
9	Grain Mfr.				7.3	2.5																						
10	Other Fod & Soft Drink	2.2	2.3		12	10.9									3.3				2.4								2	
11	Alcoholic Beverage																											
12	Tobacco							22.2																				
13	Rubber								2.1		3															6.1	2.9	
14	Leather								2.2	18.6																		
15	Textile										27.5	2														7		
16	Clothing Manufacturers									2	20.2	4.9																2.3
17	Wood												11.2															
18	Furniture Manufacturers								2		2.5		3	2.6														
19	Pulp & Paper												6.3		13.6										2.6	9.3		
20	Printing & Publishing														6.7	6.4												
21	Iron & Steel																10.9	3.1						2.1				
22	Non-Ferrous Metals																	31.5										
23	Metal Fabricating																30.7	4.8	9.8									
24	Machinery								2.7								7.7		5.3	7.5			3					
25	Motor Vehicles								9		32						9.2	2.1	4.8		29.9		2.7	4.6				2.6
26	Other Transportation Equipment								2.3								3.6					11.5						
27	Electrical Products								4.5					3.1			4.1	7.9	4				13.1			2.1	2.5
28	Non-Metallic Mineral Products																							11.9				
29	Petroleum & Coal Products																									4.7		
30	Industrial Chemicals																								2.2	10		
31	Chemical Products																							2		19.9	8	2
32	Miscellaneous Manufactures																	2								3	4.2	4.2
33	Construction								8.1		2.8		34.1	5.1	2.6		18.9	2.4	33.9	8.2		2.3	16.8	56.6	8.2	2.4	4.2	7.7
34	Transportation & Storage								4.4													4.6			10.8			
35	Communication																											
36	Utilities																											
37	Trade														3.8										4.1			
38	Finance, Ins. & Real Estate																											
39	Owner-Occupied Dwellings																											
40	Other Services	9.7	4.7	14		4.7					2.1																3.7	1.1
	All Other Industries	10.4	5.4	14.3	7.9	13.9	12.8	2	39.5	13.7	9.8	6.1	10.4	13.4	19.7	71.9	3.6	8.9	22.4	42.7	16.6	24.1	21.4	12.9	20.2	11.1	27.2	39
	Total Sales to Industries	34.2	22.9	31.3	78.6	31	23.2	24.2	76.8	34.3	71.1	13	65	24.3	49.3	78.3	88.7	61.7	82.6	58.4	46.5	42.5	57	90.1	59.8	80.1	60.9	63.4
	Final Demand																											
	Consumer Expenditure	61.3	69.7	20.7	10.5	63.5	60.7	66.8	17	61.7	23.8	83	2.3	53.8	4.7	18.3	.2	.4	4.6	3.3	26.6	5.2	16.5	3.6	33.1	2.1	27.7	23.3
	Fixed Capital	.1	.3	.2	.4	.2	.3	.1	1.6	.1	.3	—	.7	19	.3	.2	.7	—	7.9	28.7	12.1	31.2	16.8	1.3	—	.4	.6	6
	Change in Inventory	.5	.6	2.2	.7	1.1	2.1	.4	1.7	1	1.5	1	1.6	1.2	.7	.7	1.1	.2	1.4	1.5	—	.6	3.6	1.7	1.9	.9	1.7	1.6
	Government Expenditure	—	.2	.1	—	—	—	—	.2	.1	.7	1	—	.2	—	1.2	—	—	.2	1.3	.2	12.4	.7	—	4.1	1.8	2.8	1.5
	Gross Exports	3.9	6.3	45.5	12.8	3.2	13	8.5	1.7	2.8	2.6	2	10.4	1.6	45	1.3	9.3	37.7	3.4	6.8	14.6	8.1	5.4	2.3	1.1	14.7	6.3	4.2
	Total Final Demand	65.8	77.1	68.7	26.4	68	76.8	75.8	23.2	65.7	28.9	87	36	75.8	50.7	21.7	11.3	38.3	17.4	41.6	53.5	57.5	43	9.9	40.2	19.9	39.1	36.6
	Total Gross Output	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

For a more detailed explanation of the industries' disposal of final output we take, as an example, the Meat Products industry. We observe, in Table A2., that the Meat Products industry consumes 11.9 per cent of its own final output, that is, the industry uses the described share of final output to complete its own production process; 2.2 per cent is consumed by the Food & Soft Drink industry for completion of its final product; 9.7 per cent is consumed by the industry titled "Other Services"; and 10.4 per cent is consumed by all other industries consuming less than 2 per cent of the Meat Products industry's gross output. Summing the constituents of intermediate consumption yields a total of 34.2 per cent. This implies that 34.2 per cent of the Meat Products industry's gross output is used for the production of other goods and services. The remaining consumption share of 65.8 per cent is used for immediate consumption. Consumer expenditure accounting for 61.3 per cent; fixed capital formation, or depreciation of Machinery and Equipment, accounting for 0.1 per cent; change in inventory accounting for 0.5 per cent (the positive sign indicates that there exist a build up of inventories), and gross exports or foreign consumption accounting for 3.9 per cent.

As to the disposal of subsequent industries' gross output, a similar analysis follows as per the Meat Products industry's. The reader interested about the distribution of the individual industries' gross output should consult Table 2A.

4 - Inter-Industry Requirements and Sales of Canadian Manufacturing Industries

To determine the macro-locational requirements for manufacturing industries we need to express both the inter-industry requirements and

the interindustry sales in terms of its total, that is, in terms of total requirements and sales. This, in turn, will permit to associate a single weight to the technical relationship or linkages which any industry i will have with any other industry J. In other words, industry i will have two basic needs which have to be fulfilled by any industry J. These include the intermediate inputs from industry J to industry i, usually referred to as backward linkages, and/or industry i's intermediate sales to industry J referred to as frontward linkages. These individual industry needs were expressed separately by Table 1A. and Table 2A. respectively. The purpose of the present exercise is, inter alia, to combine the respective weights of the described inter-industry need and express it in terms of its total need, or in terms of total requirements and sales. This is accomplished by simply adding the inter-industry requirements and the inter-industry sales presented in Tables 1A. and 2A. respectively. The weight of each sector is then determined by dividing the contribution of each sector, in terms of both requirements and sales, by the individual industry's total requirements and sales.

Table 4A., The Inter-Industry Requirements & Sales of the Meat Products Industry

No.	Industry	Requirement & Sales in % of gross output	Requirement & Sales in % of total requirement & sales
1	Agriculture	55.4	34.3
10	Food & Soft Drink	2.2	1.4
37	Trade	3.8	2.4
40	Other Services	9.7	6
	All Other Industries	20.9	13
	Imports	3.5	2.2
	Final Demand	65.8	40.8
	Total Requirement & Sales	161.3	100

The first column of Table 3A. is derived by combining the data, pertaining to the Meat Products industry, of Table 1A. and Table 2A, as previously described. The second column is arrived at by dividing each sector, shown in the first column by the industry's total requirements and sales. The weights derived in this way reflect the total linkage, in terms of percentage, of industry i to any other industry J.

It should be observed that intra-industry need, the share of the industry's gross output used as an intermediate good, as well as value added are excluded from Table 3A. This is self-evident since the present analysis attempts to assess the extent to which inter-industry linkages will influence each industry's production location. It is obvious, therefore, that we should not be concerned with intra-industry need. The same rationale applies to the exclusion of value added.

The procedure described in the above paragraphs and applied, as an example, to the Meat Products industry is extended to cover all manufacturing industries. The results of the exercise is shown in Table 4A. The numerals under each industry No. indicates the weight of both backward and frontward linkages; as such, it reflects the contribution of the sector associated with in the overall inter-industry relation of the individual industry. For example, the Meat Products industry's final demand sector plays a significant role to the industry's need; that is, it contributes 40.8 per cent of the Meat Products industry's total requirements and sales. It is followed by the Agricultural sector, contributing 34.3 per cent, and by "All Other Industries" contributing 13 per cent of the industry's total need.

TABLE 4.A

THE INTER-INDUSTRY REQUIREMENTS & SALES OF MANUFACTURING INDUSTRIES IN PERCENTAGE OF TOTAL REQUIREMENTS & SALES

No.	Industries	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Agriculture	34.3	29.4		51.4	5.6	3.8	21																	5.1	4.8	3.5	
2	Forestry												18.3		10													
3	Fishing & Trapping			23.9																								
4	Petroleum & Gas Wells																								29.6			
5	Mines				1.4												22	28						4.7	1.1	3.4	1.3	
6	Meat Products						2.8			3.3																		
7	Dairy Products						2.3																					
8	Fish Products																											
9	Grain Mills					3.9																						
10	Other Food & Soft Drink	1.4	2.7				2.9								2.7				1.7								2.6	
11	Alcoholic Beverage																											
12	Tobacco																											
13	Rubber									2.6	2.7			1.3													1.5	
14	Leather								1.4																	4.4		
15	Textile								8.1	2.1		23.1		5												5.1		
16	Clothing Manufacturers									1.5	18.2																	1.6
17	Wood													5.1	2.6													
18	Furniture Manufacturers								1.3		2.2		2.2															
19	Pulp & Paper		1.9	1.9	1.3	2.7	2.5	4.1			1.8			1.4		12									1.4	6.8		1.8
20	Printing & Publishing														5.4													
21	Iron & Steel													1.7				2.6	11.7	4.1	3.7	3.9	1.9	1.6				
22	Non-Ferrous Metals																3.1		2.9			1.5	5.7					2.3
23	Metal Fabricating			1.3		1.9								3.5			22.4	4		4.8	3.4	3.4	3.3					2
24	Machinery								1.8								5.6		3.7			1.8	22					
25	Motor Vehicles								5.9		2.9						6.7	1.7	3.4				19	3.5				1.8
26	Other Transport Equipment								1.5								2.6											
27	Electrical Products								2.9					2			3	6.5	2.8	2.4	1.7	2.1					1.4	1.7
28	Non-Metallic Mineral Products						1.9																					
29	Petroleum & Coal Products																											
30	Industrial Chemicals								5.5		2.7				2											6.3		
31	Chemical Products								3.6																2.5			1.4
32	Miscellaneous Manufactures									1.7		1.6		1.9				1.6						1.5	16	7.1	4.9
33	Construction								5.3		2.5		25.2	3.3	2.1		15.8	2	23.8	5.1			12.7	43	4.3	1.7	2.8	
34	Transportation & Storage				1.3				2.9													3.4			9.6			
35	Communication															1.4												
36	Utilities														2.1		1.6							1.7		3.5		
37	Trade	2.4		2.1	2.1	1.7			1.5	3.6	2.6	2.5	2.8	2.9	4.4		2.4	1.9	1.4	1.5	1.7	1.5	1.4	1.6	2.2	1.5	1.8	1.4
38	Finance, Ins & Real Estate																											
39	Owner Occupied Dwellings																											
40	Other Services	6	3	8.3		3	2				1.9										1.7							
	All Other Industries	13	12.8	18.5	24.3	32.9	24.7	13	36.5	24.1	21.7	12.4	21.8	17.6	24.5	64	13.8	16.5	26.2	41.5	26.2	30.3	29	27.7	17.6	21.1	37.6	38.8
	Imports	2.2	1.4	3.2	—	5.1	5.9	2.3	8.8	10.4	15.6	4	3.8	4.2	3.2	6.9	9.3	5.5	9	14.9	16.4	9.8	11.3	7.2	5.2	8.6	7.2	14.1
	Final Demand	40.8	48.6	40.8	17.1	43.1	51.1	59.6	15	50.6	26	56.3	25.9	49.6	41.8	16.7	8.3	31.7	12.2	25.7	45.2	42.3	31	7.5	21.3	14.5	25.8	25
	Total Req & Sales	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

So that the weights outlined in Table 4A. reflect the importance of each sector in terms of the industry's macro-locational requirements, it becomes necessary to assume that each industry has an equal sectorial preference. In other words, the assumption will imply that 1 per cent of the respective industry's total need from any sector i will be as preferred to 1 per cent originating from any other sector J.[1] In this way, the industry's sectorial weights of Table 4A. will, as well, reflect the importance of each sector as the industry's macro locational requirements. It is evident, then, that the most important macro-locational requirements of the Meat Products industry are identified, firstly with the final demand sector, and secondly with the Agricultural sector. As to the minor industries aggregated by the term "All Other Industries", they contribute 13 per cent of the industry's total requirements and sales. It seems, then, that the presence of a high range of differentiated industries is not an important macro-locational requirement for the Meat Products industry.

The macro-locational analysis to subsequent manufacturing industries follows in a similar manner as per the Meat Products industry's. Also, since the sectorial weights shown by Table 4A. directly correspond to the im[illegible]e individual industry's macro-locational requirements, [illegible]e 4A. become therefore self-explanatory. The rea[illegible] macro-locational requirements to subsequent [illegible] referred to Table 4A.

[illegible]ed that this assumption has been applied to [illegible]ustry requirements and sales. Here it is ex[illegible]s well, the final demand sector.

It should be emphasized that the above analysis concerned with the industry's macro-locational requirements has been rendered somewhat limited by the assumption of the industry's equal sectorial preference, and as such the analysis will not have general applicability. For i.e., the present analysis will not apply to the more usual cases involving industries identified either by "weight gaining" or "weight loosing". In the former case, the industry's finished product will have a larger per-unit weight than the industry's intermediate inputs which given the assumption of homogeneous transport rates, will imply, within the classical framework of location theory, that such industries will give priority to locational sites close to its consuming centres. Alternatively, cases involving weight loosing industries, that is, industries whose finished product has a lesser per unit weight than the industry's intermediate inputs, will give priority to locational sites close to its intermeidate inputs.

However, even though the present macro-locational analysis remains limited in its application in the sense that the industry's equal sectorial preference will not apply to the more usual cases, it remains useful in identifying the industry's possible locational requirements originating from the inter-industry relation framework. This information can, in turn, be used by a region seeking to promote an industrialization policy in the following ways. Firstly, it can be used as a general method identifying the possible locational requirements for a given industry. The region can, then, compare these findings with its own economic structure to determine the extent to which the region can fulfill the industry's macro-locational requirements. If the results of the comparison are favourable, then,

the region will proceed to attract the prospective industries. Secondly, the inter-industry relation framework may be used in the development of a more rigorous approach to locational analysis, wherein the attempt will be, as well, to identify, on more realistic grounds, the industry's locational requirements. The latter approach, since it is developed in the main body of this study, is not discussed in the present context.

APPENDIX 5A

THE REGIONAL DISTRIBUTION OF DOMESTIC DEMAND (IN THOUSANDS OF $)

NO:		NFLD.	P.E.I.	N.S.	N.B.	QUE.	ONT.	MAN.	SASK.	ALTA.	B.C.	TOTAL
1	Agriculture	11,164	2,484	21,377	11,077	195,091	306,346	33,479	33,617	55,407	79,102	754,144
2	Forestry	890	198	1,704	1,282	15,651	24,419	2,669	2,680	4,417	6,305	60,115
3	Fishing & Trapping	21	15	155	117	1,414	2,220	243	244	402	513	5,467
4	Petroleum & Gas	809	180	4,549	1,165	14,137	22,199	2,426	2,436	4,015	5,723	54,699
5	Mines	2,232	630	5,422	4,078	49,980	77,697	8,491	8,526	14,053	20,062	191,271
6	Meat Products	17,960	3,996	34,388	25,863	313,841	492,818	53,857	54,079	89,133	127,250	1,213,185
7	Dairy Products	13,782	2,847	24,474	18,407	222,365	350,744	38,331	38,489	63,437	90,566	863,123
8	Fish Products	1,214	270	2,324	1,748	21,206		3,639	3,654	6,023	8,598	81,975
9	Grain Mills	2,589	576	4,952	3,728	45,289	71,037	7,763	7,796	12,048	18,342	174,073
10	Other Food & Soft Drink	26,160	5,598	48,174	36,282	439,661	690,389	75,449	75,760	124,367	178,265	1,699,555
11	Alcoholic Beverage	6,972	1,440	12,392	9,320	113,096	177,592	19,408	19,488	32,120	45,856	437,184
12	Tobacco	9,450	990	8,620	6,408	77,754	122,094	13,343	13,398	22,083	31,526	300,566
13	Rubber	2,023	450	3,873	2,913	35,343	55,498	6,065		10,033	14,330	
14	Leather	4,095	900	7,745	5,825	70,685	110,995	12,130	12,180	20,075	28,660	273,240
15	Textile	8,009	1,782	15,335	11,524	139,956	219,770	24,017	24,116	39,749	56,747	541,015
16	Clothing Manufactures	15,695	3,492	30,051	22,601	274,558	430,661	47,064	47,258	77,891	111,201	1,060,172
17	Wood		252	2,167	1,631	19,792	31,079	3,396	3,410	5,621	8,025	76,506
18	Furniture Manufactures		1,602	13,786	10,369		197,571	21,591	21,680	35,734	51,015	486,367
19	Pulp & Paper		666	5,731	4,311		82,136	8,976	9,013	14,856	21,208	202,197
20	Printing & Publishing	9,045	900	7,745	5,825	70,685	110,995	12,130	12,180	20,075	28,660	282,296
21	Iron & Steel	566	120	1,081	816	9,896	15,529	1,698	1,705	2,811	4,012	38,513
22	Non-Ferrous Metals	293	58	465	350	4,241	6,660	728	731	1,205	1,720	16,387
23	Metal Fabricating	6,634	1,476	12,702	9,563	115,923	182,032	19,893	19,976	32,923	47,002	448,113
24	Machinery	11,569	2,574	22,151	16,660	202,189	317,446	34,692	34,835	57,418	81,968	781,969
25	Motor Vehicles	28,137	6,148	44,301	33,319	404,318	634,891	69,334	69,670	11,483	168,935	1,450,586
26	Other Transportation Equipment	9,465	2,106	18,123	13,631	165,403	259,728	28,384	28,501	46,976	67,064	639,381
27	Electrical Products	15,776	3,510	30,206	22,718	275,672	432,881	47,302	47,502	78,293	111,774	1,065,639
28	Non-Metallic Mineral Products	1,214	270	2,324	1,748	21,206	33,299	3,639	3,654	6,023	8,598	81,975
29	Petroleum & Coal Products	9,870	2,196	18,898	14,213	172,471	270,838	29,597	29,719	48,983	69,990	666,786
30	Industrial Chemicals	728	162	1,394	1,049	12,723	19,979	2,183	2,192	3,614	5,159	49,183
31	Chemical Products	8,090	1,800	15,490	11,650	141,380	221,990	24,260	24,360	40,150	57,320	546,480
32	Miscellaneous Manufactures	6,472	1,440	12,392	9,320	113,096	177,592	19,408	19,488	32,120	45,856	437,184

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