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Abridgment

Impact of Transportation on Regional Development

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The objective of this study was to examine the relation between transportation costs and level of service and regional economic development to determine whether public expenditures on transportation infrastructure and freight rate subsidies can be expected to stimulate industrial development in a region. To fulfill this objective, the importance of 13 factors, which enter the decision to locate in a particular region, was rated by a sample of industrial firms in the Atlantic region of Canada. Five transportation-related factors were assessed among other location factors to determine their relative importance in attracting industry to the region. Industrial location has been used as a proxy for regional economic development in this study, as has been done in previous studies elsewhere. A part of the study traced the developments in location theory and empirical studies that have been concerned with the relation between transportation and regional development. An empirical approach was developed by using the location factor preference indices model to assess the subjective ratings of the plant-location factors for the industries contained in the sample. This model provides a numerical analysis of the subjective survey data.

This study investigates the relation of transportation and regional economic development by using the case of the Atlantic region of Canada. This focus must not be confused with transportation as a component of a regional economy, which is indisputably of vital importance. Instead, this paper deals specifically with the role of public expenditures to improve transportation costs, service, and infrastructure as a policy instrument to enhance economic development.

The contribution of this paper is twofold. On one hand, a method of analysis of location factors is presented that is empirical, regionally case-specific, and easily undertaken. By including transportation factors among other location factors, the degree of importance of transportation in regional development can be determined. On the other hand, the location factor preference indices (FPI) model analysis, as developed, is applied to the Atlantic-region case; in this case, the contribution of the research is a clearer understanding of the relative importance of selected industrial location factors in the region for input to regional development and transportation policy. This research attempted to fulfill a need for an uncomplicated and inexpensive method of assessing transportation in the context of regional economic development.

LOCATION THEORY AND ANALYSIS: HISTORICAL DEVELOPMENTS

The premise that transportation costs are the major deterrent that affects industrial location in a particular area has persisted since the early theoretical works of Frederich and Weber (1). The formal location theory that emerged was a classical economic theory with typical classical assumptions. It assumed, either explicitly or implicitly, such things as economic rationality, complete information concerning source of materials, size of markets, production mix, transportation rates, and complete factor mobility. This static model was further simplified by assuming transportation costs proportional to distance and holding everything but transportation costs constant. The obvious solution determined by using this plant-location model is to choose a site that minimizes transportation costs.

Major works by such authors as Hoover, Losch, and Isard added some realism by relaxing some of the assumptions, such as product homogeneity, perfect competition, freight rate linearity, and the homogeneous distribution of economic factors. All of the works, however, maintained the unquestioned basic

Table 1. Location FPI of disaggregated sample subgroups.

Location Factor	Province				Industrial Sector				Time Period		
	NB	NS	NFLD	PEI	PULP	SAW	FOOD	MANU	PBW	PWD	PPD
MKT	1115	1127	524	1318	987	1105	1082	1153	1116	1138	965
RAW	1196	1378	1067	852	1544	1740	1489	515	1487	1410	545
LAB	893	973	553	933	398	827	748	1244	606	777	1513
GFA	561	489	2939	694	1356	309	457	1106	193	349	2205
ROAD	1041	1057	218	1426	716	976	1296	976	749	1192	1012
RAIL	841	1106	624	604	837	840	652	1065	1114	952	443
AIR	85	77	104	104	61	33	106	118	0	63	229
SHIP	707	625	1194	669	1324	601	493	699	1054	591	483
PROW	614	615	799	725	1122	451	860	392	749	682	364
PROE	622	452	824	725	772	252	699	660	674	521	586
PRI	526	368	592	556	237	619	396	515	456	528	396
OMR	1128	1463	305	1290	281	1709	1300	1101	1391	1305	782
RATE	673	270	257	104	366	537	423	458	412	492	476

premise of classical location theory that transportation cost, as a function of distance, was the key variable factor in choosing a plant site.

Although transportation cost studies have shown transportation costs to be considerably lower than normally presumed, they have not demonstrated whether regions that have relatively higher transportation costs than competing regions are viewed by industry as poor site locations. In other words, these studies do not provide a connection between transportation costs and regional development that is of great concern to regional policymakers. Furthermore, reliable transportation cost data are extremely difficult to obtain. Manufacturing firms are often uncertain of their transportation cost component, and published tariffs for products may not reflect the actual changes that are taking place. For these reasons, transportation cost studies are of limited value in determining transportation and regional development policy.

In conclusion, it has been argued that classical location theory is of no use as a policy tool due to the multitude of necessarily unrealistic assumptions and its failure to include all of the economic and noneconomic location factors that are known to enter, in varying degrees, the decision to locate a plant in a region. In addition, it is a microeconomic model and, at best, applies only to the choice of a plant site by an entrepreneur within a given region, not to a location choice among regions. In this case, classical location theory does not provide a good proxy for regional economic development (i.e., the attraction of new industry to stimulate the regional economy).

If industrial location is to serve as a proxy for regional economic development for policy analysis, the collective requirements of the individual firms within the region should be determined. Once the positive or attractive factors are known, in addition to those weaker or possibly detrimental factors, policies can be developed to promote and improve the region as a base for expanded industrialization. What is required is an approach that gives a quantitative ordering of the significance of all plant-location factors, both economic and noneconomic, that enter the decision to locate in a region.

LOCATION FPI MODEL

The location FPI model presented in this paper has been conceptually adapted from Burnett's (2) multidimensional scaling measurement technique for predicting travel behavior. Before demonstrating model development, it is necessary to outline the data-collection procedure and evaluation-assignment scheme used in this research project. First, a representative sample of firms from the study region was selected. Then each owner or manager was presented a questionnaire during a personal interview, which asked them to assess the list of plant-location factors and rate each according to its importance in the decision to locate in the region. Three levels of importance were distinguished. If the factor was very important, a value of 2 was assigned; if somewhat important, a value of 1 was assigned; and if unimportant or irrelevant, a value of 0 was assigned. This location-factor rating approach is very similar to Wheat's (3) scoring system that he developed to assess the Fantus study. However, the ambiguous distinction between "of critical importance = 3" and "of primary importance = 2" has been replaced by the single factor that rates very important = 2. Also, the grouping together of "minor or no importance" has been changed to irrelevant or unimportant = 0.

The location FPI model produces an index for each location factor in the following form:

$$FPI_{j,s} = \sum_{n=1}^{N_s} \left(FR_{j,n} \div \sum_{j=1}^{J} FR_{j,n}\right) \div N_s \qquad (1)$$

where

- $FPI_{j,s}$ = location FPI for factor j in sector or disaggregate subgroup of firms s (j = 1,2,3...,J),
- J = total number of location factors,
- N_s = total number of firms in sector or disaggregate subgroup s,
- $FR_{j,n}$ = location factor rating of factor j by firm n (n = 1,2,3... N_s), and
- $FR_{j,n} \div \sum_{j=1}^{J} FR_{j,n}$ = location FPI of factor j for firm n.

Each firm needs only to rate each of the j number of location factors on the 0-1-2 level of importance rating scheme basis. At the microfirm level, the j factor preference indicates $FPI_{j,s}$, where j = 1,2, ...,J is produced and indicates the relative importance of each factor as assessed by the individual firm.

For the aggregate location FPIs ($FPI_{j,s}$), the indices from the N_s number of firms are summed for each factor j and averaged for the disaggregate subgroup s. The limiting range for the location FPI is from zero (the case where all firms of a subgroup rate a location factor as unimportant or irrelevant) to one (the case where all firms rate a location factor as either somewhat important or very important while rating all other location factors as unimportant or irrelevant). A scaling factor of

Product Market				Plant Size			All Firms
DEM	EEM	DRM	ERM	LT50	F50T150	GT150	
903	502	1322	1260	1232	1140	857	1090
1235	1229	1217	1149	1209	1035	1442	1227
843	854	974	958	988	966	725	901
1123	1754	275	89	368	1132	843	745
952	854	1092	1124	1168	986	844	1014
786	613	996	1084	745	989	943	880
115	61	45	61	51	160	49	84
946	1387	407	411	335	614	1274	706
755	918	467	527	551	366	984	626
627	679	530	531	531	506	728	583
486	281	461	555	564	487	348	475
793	281	1719	1802	1704	1275	497	1205
437	588	496	448	554	345	466	464

10^4 may be used to yield positive integer indices ranging from 0 to 10 000.

The total sample was disaggregated to the following subgroups:

1. Subregions: provinces, states, or geographic and economic regions;
2. Industrial sectors: forest, agriculture, and primary and secondary manufacturing;
3. Time of plant location: time periods affected by historical, economic, or political changes;
4. Plant size: number of employees, asset value of plant, and gross annual revenues; and
5. Market orientation: whether products are marketed regionally, externally, or both.

LOCATION FPI MODEL ANALYSIS OF ATLANTIC REGION

To begin the regional case study, a sample of 95 Atlantic-region firms was selected that represent the forest product, food processing, and manufacturing sectors. A questionnaire was designed and presented to the owner or manager of each firm, who rated each of 13 location factors.

The respondents were asked to rate each of 13 plant site-location factors according to their importance in the decision to locate in the Atlantic region. Each factor was assessed independently and rated as to whether it was considered very important, somewhat or moderately important, or unimportant or irrelevant. The 13 plant site-location factors used in the Atlantic region study are as follows:

1. MKT--Proximity of plant site to prospective market,
2. RAW--proximity of raw materials used in production,
3. LAB--Availability of skilled and/or stable labor force,
4. GFA--Availability of government financial assistance and/or incentives,
5. ROAD--Accessibility of the plant site to highways,
6. RAIL--Accessibility of the plant site to railways,
7. AIR--Accessibility of the plant site to air services,
8. SHIP--Accessibility of the plant site to ports and waterways,
9. PROW--Availability of water for use in processing,
10. PROE--Availability of electricity for use in processing,
11. PRI--Proximity of related industry to the plant site,
12. OMR--Residence of the owner or manager located at or near the plant site, and
13. RATE--Existence of reasonable transportation rates for commodity movements to and from the plant site.

Of the five factors that relate to transportation, ROAD, RAIL, AIR, and SHIP refer specifically to the availability of modal service and infrastructure. RATE refers to the associated level of transportation costs, which include subsidies on designated freight rates and the service available to, and chosen by, the firm. By including the five transportation factors instead of a single general transportation cost and service factor, not only can transportation be assessed among the other location factors, but the cost and service aspects of transportation and the relative importance of each transportation mode can also be distinguished.

The table below illustrates the resultant indices, ranked by their relative importance, of the location factors by using the entire sample of firms:

Rank	Location Factor	FPI	Rank	Location Factor	FPI
1	RAW	1227	8	SHIP	706
2	OMR	1206	9	PROW	626
3	MKT	1090	10	PROE	583
4	ROAD	1014	11	PRI	475
5	LAB	901	12	RATE	464
6	RAIL	880	13	AIR	84
7	GFA	745			

(Note that the grand sample mean for the FPI is 769.) As previously stated, care should be taken when interpreting results from the entire sample. However, the inherent biases of the total sample can be used to advantage. By establishing bases for disaggregating the sample into subgroups (i.e., the firms that share common characteristics distinct from the other subgroups), each factor can be viewed in relation to its relative importance within its subgroup. This treatment not only reveals the biases of looking only at the entire sample but also indicates the particular concerns of the subgroups within the sample. Table 1 is a summary of the location factors for the various subgroupings of the sample. The subgroups used in Table 1 are as follows: NB, New Brunswick; NS, Nova Scotia; NFLD, Newfoundland; PEI, Prince Edward Island; PULP, pulp mills; SAW, saw mills; FOOD, food processing industry; MANU, secondary manufacturing; PBW, pre-World War II; PWD, post-World War II; PPD, post-regional development period (1969); DEM, dominantly external; EEM, entirely external; DRM, dominantly regional; ERM, entirely regional; LT50, less than 50 workers; F50T150, between 50 and 150 workers; and GT150, greater than 150 workers.

CONCLUSIONS

As previously mentioned, the lack of industrial development in the Atlantic region was claimed to be the consequence of the transportation barrier. Without a transportation system compatible to other parts of the country, the Atlantic region may not have accommodated its existing industries. There are also direct and indirect benefits from construction projects alone. But, although public expenditures on transportation infrastructure create economic activity from the capital inflow to the region, the effects are temporary and diminish after the project is completed. Despite these positive effects, the results of this study and the persistent regional disparities in the Atlantic region indicate that increased investment in infrastructure for construction and expanding system capacity is not likely to directly attract new industry to the region. It is apparent that there are other factors equally or more important in successfully attracting industry to the region.

In the total sample, the transportation-related location factors ranked fourth (ROAD at 1014), sixth (RAIL at 880), eighth (SHIP at 706), twelfth (RATE at 464), and thirteenth (AIR at 84). The average of all the transportation location factors is 630, which, if taken as a single location factor, ranks transportation sixth out of nine location factors and is well below the grand sample mean of 769. If only the three major freight-carrying modes [trucking, rail, and marine (ROAD, RAIL, and SHIP)] are combined for a transportation location factor, which leaves out the air freight mode (AIR) and the subsidized freight rates (RATE) factors that rated very low, transportation still only ranks fifth at 867, behind RAW, OMR, MKT, and LAB.

In the period following World War II to the end of 1960, huge public investments in transportation infrastructure were made, particularly in the highway system. The air system also developed to serve the larger urban centers during this period. Four transportation modes became available to industry (i.e., trucking, rail, marine, and air) for moving their input materials and output products. However, the importance of transportation as a location factor, as indicated by the averaged index of the four modes, dropped significantly during this period to 700. During the period 1945-1969, transportation ranked fifth of 10 factors, behind RAW, OMR, MKT, and LAB.

In the recent period (since 1969), transportation investment has continued, and particular emphasis has been on the air mode and marine port facilities. However, the combined average index for the four transportation modes dropped further in importance to 542.

However, ROAD by itself ranked third during the post-World War II period, following GFA and LAB. The growing importance of the highway trucking mode of transportation in recent decades to Atlantic-region industry indicates that public funds would be best spent on highways and secondary and service roads. In fact, the difference between the importance of ROAD versus the other transportation modes is substantial enough to suggest that public capital expenditures on airport facilities, for instance, may have negative effects from the opportunity cost of not spending the funds on highways. This still does not mean, however, that good highways necessarily draw new industry, but the ROAD factor is certainly an important consideration to industry.

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Regulation of Road Haulage in United Kingdom: A Critical Review

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Road haulage is the dominant form of freight transportation in the United Kingdom. For a variety of economic and political reasons, it has been the subject of government control and regulation. Recently, public policy with regard to road haulage has come under review and there are signs that official attitudes toward the sector are changing. This paper looks at the ways in which road haulage is regulated in the United Kingdom and considers the economic justifications advanced in support of current policies. The effects of regulation are considered in some detail, although the extent to which this can be done satisfactorily is severely constrained by the paucity and inappropriateness of available data. The paper specifically questions the ways in which policy is formulated in the United Kingdom and looks at the three recent official studies of road haulage that, in turn, have reviewed pricing, licensing, and environmental issues. The United Kingdom's membership in the European Economic Community has, in recent years, introduced a new dimension into road-haulage policy formulation. The evolution of a Common Transport Policy has posed its own problems, as described in the last section of the paper.

In aggregate terms, road haulage dominates inland freight transportation in the United Kingdom. Between 1953 and 1979, the ton kilometers moved by road haulage more than tripled while its share of the total freight market nearly doubled. The increase was particularly rapid during the late 1950s and throughout the 1960s, but the rate of increase, although still pronounced, slowed down somewhat in the 1970s (see Table 1). Further growth in road freight traffic to the end of the decade is forecast (see Figure 1). This performance contrasts markedly, for example, with that of British Rail, which suffered both a relative and an absolute decline in its freight business over this period.

The increase in road-haulage ton kilometers is attributable, to a large extent, to a substantial rise in the average length of haul--from 35 km in 1953 to 69 km in 1979. This trend represents something of an encroachment into the longer-distance freight market, traditionally the domain of rail transportation. Another factor worthy of note is the greater use made of larger lorries; nationally, recent years have witnessed a fall in the ton kilometers moved by lighter classes of lorry and a rise in that done by lorries of more than 8-t unladen weight (uw). For example, in 1967 vehicles more than 8-t uw accounted for only 24 percent of the ton kilometers done by lorries but by 1979 this had