876c

AN ANALYSIS OF ECONOMIC POLARIZATION

A METHOD FOR THE ANALYSIS OF ECONOMIC POLARIZATION:

TWO CASE STUDIES;

HALIFAX-DARTMOUTH, NOVA SCOTIA

AND

QUEBEC CITY, QUEBEC

by

JOHN M. JOZSA, B.A.

A Research Report

Submitted to the School of Graduate Studies

in Partial Fulfillment of the Requirements

for the Degree

Master of Arts

McMaster University

September, 1975

MASTER OF ARTS (1975) McMASTER UNIVERSITY
(Geography) Hamilton, Ontario

TITLE: A Method for the Analysis of Economic Polarization: Two Case Studies; Halifax-Dartmouth, Nova Scotia and Quebec City, Quebec

AUTHOR: John M. Jozsa, B.A. (McMaster University)

SUPERVISOR: Dr. Fred L. Hall

NUMBER OF PAGES: viii, 128

ABSTRACT

A methodology is developed that describes the spatial-temporal trends of economic welfare levels in a region. The focus of the region is assumed to be a key city; that is, a growth pole. The methodology depicts the degree of economic polarization on the pole as time and distance change. Two case studies, Halifax-Dartmouth and its hinterland the Province of Nova Scotia and Quebec City with a hinterland 160 miles in diameter were used to test the methodology. For the 30 year period 1941-1971, the nature of economic growth in the pole cities and their hinterlands and the pole-hinterland growth relationship were determined. Some conclusions regarding the requirements for improved regional welfare levels are offered. The methodology proves itself to be sufficient for the description of spatial-temporal trends in regional welfare levels. These descriptions are suitable for use in preliminary policy formulations and subsequent preliminary plan evaluation.

ACKNOWLEDGEMENTS

Thanks to Fred Hall who taught me the value of making haste slowly, to Lee Liaw for his help with the statistical work, and to Susan (Tait) Jozsa for her ability to listen.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE - INTRODUCTION

> The method of growth poles, supporting the need for the concentration of investments in certain well selected places and in complexes of optimal size and structures, has arisen as one of the most effective responses [to the optimal use of limited resources], offering a scientific and operational basis to the policy of regional development and the planning of national territory.
>
> (Petrella, 1972, p. 193, U.N. Research Institute for Social Development Conference)

While not all people share Petrella's enthusiasm for pole centered planning the notion of selective investment in a centre that will transmit growth impulses to its hinterland remains appealing largely by virtue of its simplicity and promise of practical applications. If the world economic and resource situations continue to tighten the 'pole method' may become a necessary and functional alternative to the 'big push' style of regional development and growth.[1] For the method to be an effective alternative clear statements on where and when a given pole strategy is appropriate are required. Furthermore, the spatial and temporal trends in the economy of the pole and of the whole region need to be modelled and explained. Without such an analysis pole theory will remain an unproven and unmeasured quantity. The linkages within the sectors of a given pole region's economy need to made explicit. Even

---

[1] 'Big push' refers to the wholesale saturation of a region with investment capital in the belief that development and or growth will be stimulated.

more do the changes in these linkages through time want for explanation.

Pole theory would appear to have a sound basic assumption; i.e., that economic growth and development is basically unbalanced. The theory suggests that investment should be focused on areas where growth or development is or can be polarized. Hermansen (1972) described a polarized region as one that may be heterogenous in its constituent parts, but it should be localized in geographic space. Its parts achieve inter-dependency via complementarity and interplay focused on a regional centre of gravity. Simply stated a polarized region should have an economy whose sectors coexist and are highly interactive. The economic activity in the regional centre acts as a signpost for the regional economy. But the theory is not fully developed, it is conditional. If the investment and infrastructure requirements are met growth can occur but need not necessarily occur.[2] If the pole does show sign of growth, will it pass on its progress to the hinterland or will it grow at the expense of the hinterland? Furthermore, can we find and describe the spatial and temporal economic relationships between the pole and its hinterland? In this research report we will attempt to develop a methodology to detect and describe pole-hinterland relationships. We will then test this methodology by undertaking two Canadian case studies. There is reason to believe that growth pole activity has or should have taken place in each case study area. If this methodology is successful we can then determine whether the polarization of the region on the pole (if

---

[2] For that matter we cannot be sure of the scale of any ensuing growth trend or which sectors of the pole and regional economy will be most effected by the pole's activity.

polarization exists) is having a positive or negative effect on the regional economy.

The pole method is implicit (and explicit) in much of Canada's regional development experience. Such is necessarily the case by virtue of Canada's size, scattered arrangement of densely inhabited areas and physical cultural and political barriers. A few examples will serve to illustrate the point.

King (1974) suggested that the growth pole notion has "received quasi official sanction" in Ontario regional planning policies. The "Design for Development" explicitly calls for the location of "growth points" in the province. More recently the Central Ontario Lakeshore Urban Complex Taskforce has sought to bring the "Design for Development" notions closer to an operational state. The up-dated objective is to draw off growth from Toronto and re-locate it in the Toronto hierarchy of satellites. (COLUC Taskforce, 1974).

The province of Quebec approached growth pole policy with a view to creating two or three poles to the East of Montreal. Quebec planners determined that prospective poles East of Montreal (i.e., Sept-Isles, Quebec City and Trois Rivieres) were not generators of growth (i.e. development poles) but strong reactors to growth generated elsewhere (i.e. growth poles). The policy chosen was not to draw off growth from Montreal but to strengthen Montreal and improve the satellite cities' ability to react positively to Montreal's activity as a development role. The essence of the plan was to strengthen the Montreal urban hierarchy in order to keep Montreal competitive with Toronto and thus set the stage for a more secure economic future for Quebec (Higgins,

1970, in Hansen ed., 1972).

The Atlantic Provinces Economic Council estimated that 150,000 new job opportunities would be required in the Atlantic Provinces in the 1966-76 decade. The Council stated that for such an objective to be met the Federal Government's Designated Area Programme would have to be extended to the whole Atlantic region (i.e. not just rural and the most impoverished areas). Designated area status has since been extended to all major towns and cities in the region. The move implicitly accepts the place of pole planning for the Atlantic Provinces (Lutterell in Kuklinski, ed., 1972).

However intuitively sound the pole plans appear there are several hard questions to answer before the plans can be applied to actual planning problems. How can the functional relations between the sectors of the pole and regional economies be identified so that heavy investment can be undertaken with reasonable assurances of success? What sections of the pole and regional economies have natural advantages, which do not and what advantages may be presently overlooked? What interfirm transactions can be retained in the pole and region in order to reduce leakages to other already developed regions of the nation?

In the case studies we propose to describe and then offer a tentative explanation of the change over space and time in the occupation per person levels of Quebec City, and its hinterland within an eighty mile radius, and of Halifax-Dartmouth, with the Province of Nova Scotia as its hinterland. We shall regard signs of growing levels in occupation per person ratios as indicative of growth and improving economic welfare. Higher levels in this ratio indicate that fewer people have to be

supported per job; hence increased welfare levels. Granted, there are exceptions to this. For example, if the ratio rises and wage levels fall, overall welfare levels may drop. In the main we contend that higher levels in the occupation per person ratio reflect improving welfare standards.

Because the use of aggregate occupation data may mask the more selective impacts of polarized growth we have disaggregated total occupation statistics into eight sub-groups. The disaggregation will allow an analysis of which particular economic sector is most responsibe to pole activity. Having done this it will be possible to better estimate the effectiveness of past economic activity and the potential for future investment (which might be focused on the pole) and of each sector's impact on regional welfare levels.[3]

The objectives of this research can be listed in three parts:

1) Describe using a regression model the temporal-spatial variation in occupation per person levels for total occupations and eight sub-groups.

2) Assess the effectiveness of Quebec City and Halifax-Dartmouth as growth and development centres respectively.[4]

---

[3] To avoid complexity that might be misleading in this study we will be most directly concerned with the internal dynamics of the pole region's economy. We will less deeply analyze the impact of interregional economic relations. Future progress in pole theory requires the inter-regional relationships be studied in depth.

[4] Throughout this report the terms 'pole' and 'centre' will be used interchangeably. The distinction between growth and development poles will be maintained throughout (c.f. Higgins, 1970, in Hansen, ed. 1972).

3) Provide a simple technique for the analysis of pole effectiveness in transmitting economic impulses (and provide the germ of a model that will more accurately depict pole/region economic activity). It is our desire that this report add an objective and analytical dimension to the evaluation of present and potential poles and their impact on hinterland welfare levels.

CHAPTER TWO - LITERATURE REVIEW

The following pages are designed to present a brief summary of the major elements of pole theory. A discussion of pole theory's crucial points is necessary before the theory's performance in reality can be analysed or its application to planning problems considered. Modifications of pole theory for use in planning situations are discussed and then some actual pole planning policies will be described. This chapter serves to sketch the history and present state-of-the-art of pole theory and to yield pictures of both the ideal type of pole-hinterland relationships and those which we should expect to find in reality.

Growth pole literature had its 'official' beginning in Perroux's "Note sur la notion 'de poles de croissance'" in 1955. It grew into one of the largest (and in places most repetitive) literatures within the general sphere of economic development. Over-lap within the literature of the last twenty years does not mean that pole theory developments have reached an end. In fact the opposite is closer to the truth. King (1974) stated that it is still an open question whether growth pole planning or other planning strategies are more effective. He justified continued work on growth pole theory by the fact that many serious commitments have been made to pole type policies throughout the world. He concluded by saying that we are still without a formal model and that the situation will not improve unless better quality data can be collected.

ORIGINAL STATEMENTS OF THE THEORY

In his seminal statement on growth poles Perroux (1955) specified two characteristics of growth: i) it happens with variable intensity at different locations and ii) it spreads through the economy over time. Poles that have higher than average growth rates are generally dominated by propulsive industries. He goes on to state that these industries are highly specialized, grow rapidly and require large concentrations of capital. Furthermore, the growth pole usually contains a key industry which is a price leader and induces new industrial growth.

As a price leader and industry sets the price for its products or services which acts as a benchmark for other prices in the region.[1] A key industry should induce industrial growth because it needs for ancillary services must be met. For example, a major manufacturing complex requires tool and die industries and related services. Because the key industry is growing rapidly it should be able to induce and help support more new industries. Darwent (1969) suggested that the firms most likely to be induced are those whose overall importance to the region is small but due to the economics of growth the induced firms have a secure position in the regional economy. For example, one or two tool and die firms (which are linked to a key manufacturing complex) cannot be considered crucial to a regional economy. But because of the heavy investment and long term commitments required to develop the manufacturing

---

[1] A similar situation exists on the national scale where the price for ingot steel sets a guideline for many other price levels.

complex the tool and die firms are also guaranteed security. Darwent was not only refering to induced firms directly related to key industries but also to those indirectly connected. Some of these are retailers, wholesalers and service establishments that are required to serve the needs of a growing pole. The complex of propulsive and key firms gives rise to external economies within the pole. Given these basic elements the other requirements for self-sustained growth can be met.[2]

Dissatisfaction with balanced growth theory and central place theory lead to the hasty application of Perroux's pole theory (conceived of in abstract economic space) to regional development problems framed in geographic space. Nichols (1969) summed up the essence of a growth pole in the context of geographic space. "A growth pole is an urban centre of economic activity which can achieve self-sustaining growth to the point that growth is diffused outward into the pole region and eventually beyond into the less well developed region of the nation". At or about the time of achieving the status of a growth pole the pole region would become polarized.

Hansen (1972) noted two basic deficiencies in growth pole theory as applied to geographically defined problems. Firstly, very little has been learned about the temporal trends of growth within a pole and even less about how growth spreads outward from the pole. Secondly, there is a lack of essential information regarding the nature and significance of

---

2 For example: agglomeration economies, economies of scale and backward and forward linkages.

of intra-pole industry linkages. We might add that the same applies for the linkages between the pole and its hinterland. The spatial linkages within the pole and between the pole and its region are even less well defined. A survey of the literature suggests that much of the weakness in the analysis of linkages (especially spatial linkages) stems from the hurried translation of Perroux's original conception of space as a fundamentally abstract economic field into a geographically defined space.

The rush to apply growth pole theory to problems of a pole and its contiguous hinterland did the theory a disservice by forcing it on a problem it was not specifically designed to meet. While it is true that firms must locate in space and do tend to cluster it is not safe to say that all linkages, external and internal economies, agglomeration economies and complementarities exist within the pole and between the pole and its hinterland. In fact many of these flows and relationships may arrange themselves across the urban hierarchy and not between the pole and its hinterland.[3] This mixture of centre foci and cross hierarchy foci probably more closely meets with Perroux's original idea of growth poles and linkages. Simply stated, the transmission of growth is not

---

3 Growth poles may interact across the urban hierarchy. For example, an innovation in accounting techniques, growth in computer use or growth in the manufacturing sector of the economy may be communicated first between the national and regional centres; that is, Toronto, Montreal, Quebec City, Halifax, Winnipeg and so on. These flows will follow linkages that exist within the upper levels of the urban system. Depending on the complexity of the innovation or scale requirements of a specific type of growth communication to the hinterland hierarchy (eg. Halifax to Sydney, Truro, Yarmouth, Digby,...) may have a time lag attached or may not occur at all.

only a centripetal or centrifugal movement. Todd (1973) restated the basic premise of all pole theory; i.e., that there is a concentration effect on development. He suggested that the reason pole theory was looked to as a solution to spatial growth problems was that it has as its basic assumption that growth is unbalanced. Using balanced growth theory as a basis for regional planning requires that the planners assume stable technical and capital input coefficients.[4] The assumptions of stability grow increasingly untenable each year so a five year time horizon is usually placed on each phase of the plan. Pole theory postulates a sequence of localized disequilibria which demonstrate a general upward trend and does not require the assumption of stability in regional capital and technical input coefficients.

The concept of polarization turns up as one of the most essential concepts in pole theory. Because polarization can be described and measured in physical space it becomes what may be the link between the original formulation of pole theory using abstract space and the modification of the theory for application in regional development plans.

Petrella (1972) insisted that the forte of growth pole theory lies in its ability to enrich abstract and punctiform economic analysis by introducing the variable of space. One must realize that the introduction of space changes the initial conditions under which growth pole theory was conceived; a direct analogy with Perroux's concept may not be entirely possible without suitable modifications. Petrella suggested

---

[4] Input/Output analysis uses a similar set of input and output coefficients that define the levels and rates of flows between the sectors of the economy. Technical and capital coefficients are very similar measures.

that for spatial applications of pole theory special attention should be given to the concept of polarization. Polarization can be explained in terms of agglomeration in geographic space and policies which would affect polarization levels are directly related to the structures of the spatial economy in which they operate. Petrella conditioned his statement and reminded us that polarization is not automatic and has more than simple economic dimensions; eg., exogenous political input. Parr (1973) pointed out that although a polarized region may be economically and socially dominated by a node or pole the node or pole may not be in the same location as the growth pole. For example, the pole could be a new planned focus while the polarizing node could be an old element of a stable structure.

MODIFICATION AND FURTHER DEVELOPMENT OF POLE THEORY

Hermansen (1972b) credited Boudeville with being the first to take Perroux's abstract space and emphasize the regional character of economic space. Boudeville did so on the basis of Hirschman's (in Hermansen, 1972b) conclusion that for a regional economy to 'lift itself up' it must develop centres of economic strength within it. Such is the case because economic development is an unbalanced process and is propagated through chains of desequilibria. Hermansen gave conditional support to Hirschman's notion of 'trickle down'. He said that if complementarities exist in a regional economy strong support can be given for the likelihood of growth trickling down through the regional hierarchy, otherwise Myrdal's "backwash" and

"cumulative causation" may become the dominant characteristics of economic flows.[5]

Hermansen (1972a) supported the application of pole theory to the regional context because, "functional organizations generally manifest themselves in space". Pole theory is superior to central place theory in the context of regional development and planning because central place deals only with clustering in geographic space where as pole theory treats both functional and geographic clustering. He concluded that the "theory of localized poles of development may constitute a powerful tool to explain not geographical clustering per se but the geographical incidence and transmission of development among such clusterings".

Hansen (1972a) agreed with Hermansen's conclusions but wondered what size the pole city must be in order to achieve the required levels of i) polarization and ii) functional and geographic clustering. Hansen determined that small towns rarely make viable growth centres while intermediate size centres (population of 150-250,000) dominate an appropriate hierarchy of cities.[6] The size of the pole city is most

---

[5] That is, the pole and selected developed sections of the region will grow at the expense of less developed sections and that the rate of divergence will accelerate over time.

[6] A pole with appropriate hierarchy of cities would have sufficient medium size cities around it and each should have a market and population size sufficient to accept growth impulses from the pole. These 'intermediate' cities in the hinterland would in turn pass on growth to their own local hinterlands. It is doubtful that a pole has a direct inpact on the lowest levels in the regional hierachy. Without a hierarchy of large, medium and small hinterland cities the impulses from the pole may reach only one or two cities in the region or may never reach the region at all; pole linkages may then be directed only up and across the national urban hierarchy.

likely not the crucial factor. What is crucial is the need for a hierarchy of cities around the pole and a hinterland population sufficient to allow i) the development of economies of scale and ii) internalization of the beneficial side-effects of growth. More emphasis should be placed on developing the network of cities in a pole region than on the pole city itself. Without a well developed network of hinterland cities polarization levels may reach extreme values and the pole will become the focus of all flows (one way to the pole). Myrdal's backwash effects may then occur and stall the growth pole initiative.

Todd (1973) was convinced that empirical work points to increasing concentration of growth around United States cities and that distance decay may be the principal explanatory variable in the functioning of development axes (i.e., that there is a decline in rates of growth as the distance from the pole city increases). He was less sure that growth impulses spread down from a pole to its region but believed that pole growth does not have its greatest impact on the locality around the pole. Impulses do not immediately spread downward but first across the urban hierarchy (as in a central place system) between centres of similar order (cf., Erikson, 1975). This suggested to Todd that if an intermediate size city (eg. a regional capital) is planned as a pole few growth impulses would trickle down to sub-regional centres; most of the pole's impact would spread to similar regional and national centres outside the region. Forward linkages are lost to the region and backward linkages are only minor components of higher order centres.

In light of Todd's observations Nichols' (1969) earlier proposal showed strong logic. According to Nichols it is advisable to invest where the strongest linkages exist but also worthwhile to inject capital into lower order centres in the immediate vicinity of the pole. Increases in income there will create large multipliers in larger centres but not the other way around. His proposal for investment is particularly appropriate in a hinterland whose infrastructure is deteriorating; the deterioration may delay (or block) the hinterland's response to growth impulses from the pole. Todd (1973) stated that planners must avoid designating very large centres as poles because the growth generated may be transmitted across the urban hierarchy and not down or very small centres where growth may not occur at all.

Besides being a leader of regional growth, a node for economic linkages and a central social and economic focus of the region the pole has other duties. It must strive for long term growth and development and must continue to justify its position as a regional focus. These conditions cannot be met by simply maintaining the status quo. Lausen (1961) said that the key to continued growth and success of growth pole policy relied on the ability of the pole to introduce innovations and transmit them to the pole region. This notion is an important element in Schumpeter's theory of economic development. Lausen does not mean that the pole must create all the innovations for its region but that by virtue of i) its size, ii) the existance of economies of scale and agglomeration and iii) its linkages it is in an excellent position to either create innovations or accept and adapt innovations from other

parts of the national system for introduction to its region. The diffusion of innovations within the region is directly related to the directness of links to the specific information required. Lausen says that the probability for an adoption of an innovation is inversely related to the scale the innovation must be introduced at in order for it to be effective. We would add that the adoption rate of innovations in the hinterland is directly related to the level of complementarity the innovation demonstrates vis a vis the needs and potential of the hinterland. Backwash effects may be avoided if the channels of information diffusion become less selective.

The preceding summary of pole theory research suggests four major shortcomings of growth pole theory:

1) It lacks explicit statements relating the theory to empirical observations.

2) The treatment of external economies and the related agglomeration economies is insufficient.

3) There has been no agreement on the definition of external economies or the optimum size of a centre.

4) The conditions hypothesized within the spatial version of growth pole theory are insufficient to distinguish between growth and non-growth situations and between growth centres and non-growth centres.

Paelinck (1965) offered some comfort for those who choose to apply pole theory or are forced to plan in a situation that intuitively demands a strong consideration of pole theory.[7] He proposed that the

---

[7] For example, a country or region with a strongly defined primate city size distribution or distinct economic or political regional boundaries.

theory be regarded as conditional; it is valuable chiefly to the extent that it indicates the conditions under which accelerated growth can occur. Therefore the relevance of the theory must be judged in the specific situation it is to be applied in. This is the approach we will take to pole theory in the following chapters.

GROWTH POLE THEORY IN PLANNING METHODOLOGIES

The inclusion of growth pole theory in regional planning techniques comes as a reaction to traditional techniques of regional analysis that fail to provide a means for dealing with problems of applied regional policy. Hansen (1971) said that classical location theory is defficient because the criteria for optimal spatial resource allocation are based solely on the perspective of the firm and ignores the social costs of agglomeration.

Boudeville (1966) was the first to place pole theory in a spatially defined planning context. He delimited spatially polarized regions using graph analysis and gravity models and found that the polarized region must have a market large enough to support induced industries which often have market requirements as large or larger than the pole's initial propulsive and lead industries.

Hansen (1968) concurs with Boudeville's observations regarding market size. He said that it is naive to treat pole planning as simply the implantation of a large firm. The pole must be able to support an economic base of sufficient depth and breadth. As well the pole region must have (or be given) an infrastructure that will complement the pole's

economic activity. Hansen (1970) suggested that the creation of polarization forces should not be the sole concern of pole planners. The boundaries of regions and scope of plans should not be based only on polarization measures. He believes that it is of major importance for a pole to produce external economies and it is the spatial extent of these economies that should define regions for use in pole planning.

But Boudeville's approach, like classical location theory, was concerned solely with the firms' perspectives and avoided consideration of agglomeration's social implications. Hansen (1968) chose to expand on this shortcoming. He stated that an appreciation of the social benefits and costs of pole planning is especially critical where regions of low potential or over population are involved. Under these conditions a pole plans may require a policy of out-migration to poles of greater potential. Often times regional problems may not be so much technical as social, the quality of human resources may be low or there may be just too many people for the region to support. Hansen calls for more attention to investment in the human capital of the hinterland and to migration policies that may complement pole planning.

Klassen (1972a) supplemented Hansen's conclusion. He urged us to remember that regional plans should generally have their first priority to help the people of the pole region and secondly the region.[8]

---

[8] Planning that is designed primarily to help the population of a region is generally referred to as 'people planning'. Such a planning approach calls for investment plans which emphasize expenditures on social overhead capital and in some cases an appropriate migration policy.

Place planning is more concerned with developing the region in the hope that the population will benefit from investment in economic overhead

EMPIRICAL STUDIES

The next section presents a cross-section of the empirical work that has been done in growth pole research. It is designed to serve as a background for the methodology developed in Chapter Three. Each of the studies in this section describes the general relationships, phenomena and policy problems that we should expect to find in our study areas. The overall thrust of model will be based on the experience afforded by past studies particularly the type of growth pole activity the model should be able to describe. Research that pertains more directly to the actual construction of the model will be presented in Chapter Three.

Semple, Gauthier and Youngman (1973) studied growth poles around Sao Paulo, Brazil. Using a growth index composed of nine economic variables they located three poles. They found that two of the poles, besides Sao Paulo, had only a small impact on the area and that without continued government investment they might cease to exist. The only permanent pole (over a twenty year span) appeared to be Sao Paulo which indicated to them that a backwash effect may exist. Semple et al concluded that there is required i) a better understanding of the spatial impact of the pole on its region and vice versa and ii) an understanding of the ability of the pole to hold and re-cycle wealth within the region.

Richardson and Richardson (1975) investigated the relevance of growth centres in Latin America. Their work offers three observations regarding pole planning that have implications for more general planning situations:

1) The application of the notion of pole planning must be expanded beyond the economic level.

2) Reinforcing non-spatial policies are essential in a pole plan.

3) Many failures of pole planning are not due to weaknesses in the concept but to unsubstantial and short lived policy initiative.

King, Casetti and Jeffery (1969) tested the spatial interaction of a regional system of cities. They assumed that larger centres in the region functioned as subregional centres (even as growth poles) and that their influence was subject to distance decay. The study revealed that economic impulses affected each city differently and that the interaction between two smaller centres, each oriented towards a different larger centre, was weak. Their first observation supports the idea of Todd (1973) that in situ realities must be met via a custom tailored growth pole plan and the second supports the notion of Boudeville (1966) and Hansen (1970) that pole regions can be defined in space. The researchers also found that groups of cities reacted with different time lags to national trends. The spatial dimensions of the time lags were left open for future research.

Nichols (1969) studied the effect of Atlanta on its hinterland. He found that retail sales and other growth indicators did increase in the surrounding centres but the transmission of growth occurred first across the urban hierachy to other regions and then down to lower order centres in the Atlanta region. This finding suggests that there might be a considerable time lag before growth related to investment in a pole spreads down the pole hierarchy.

Erikson (1975) examined the spatial pattern of income generation related to expansions of the Boeing firm in the Puget Sound region of the State of Washington. He found that the strongest spatial ties were with New Jersey and California. Because the Seattle area does not have a lead and propulsive firm 'complex'; it exists as a one company town. Growth in the immediate area was linked to expansion of the household service sector due to the expansion (and the increased wage payments) of Boeing. His observation supports the argument that a growth pole must be composed of more than one large industry and that a large regional population is required to provide a regional market for induced industries; eg. in the Seattle case an expanded household service sector.

The above studies have one thing in common; all found indications of the diffusion of growth about the poles. None provided a complete description of i) what sectors of the economy were most responsive to pole growth, ii) the time and space dimensions of the diffusion process or of iii) the overall size of the pole's impact at a given point in time and space. The reports do not make it possible to evaluate and compare either the overall effectiveness of poles or their strong and weak point.

The empirical work to be discussed in Chapter Three provides a basis for the development of a technique of analysis that is applicable to the general case; thus opening the way for the comparison of several pole situations and improved analysis for planning purposes.

CANADIAN EXPERIENCE IN POLE TYPE PLANNING

Canada's regional development policy has taken on a semblance of growth pole planning by default. The major cities in Canada are not clustered in any one part of the country, in fact Canada has only a few large cities at all. Each city tends to be the focus of a sub-region of one of Canada's discrete economic regions.[9] Administrative and investment foci of development oriented policies have tended to be the major cities in each sub-region (eg., Halifax, Sydney, Winnipeg, Quebec City). There has been no policy statement committing part of Canada's development planning program to growth pole policies. Regardless of this non-commitment the spatial, economic and cultural divisions of the Canadian nation create de facto pole type planning situations. Development planning in Canada can best be summed up as a series of investment programs with sectional foci designed to create jobs or support and strengthen the traditional economic structure.

Higgins (1972) estimated that the divergent trends in the Canadian economy have increased since WW II and concomitantly regional differences have gained considerable political attention. He lists several programs designed to reduce disparity that are implicitly growth centred in nature. In 1969 the Federal effort was consolidated in the Ministry of

---

9 The regions are discrete in both location an economic situation. The regions are: the Atlantic Provinces, the Province of Quebec, Ontario, the Prairies, British Columbia and the Northern Territories. The range of situations runs from the new frontiers of the North, to the agricultural economy of the Prairies, to industrial Ontario and the old and sluggish economy of the Atlantic Provinces.

Regional Expansion. It provides cash grants for development projects to designated areas (which include the major centres in the area even if the centre is considered self-sustaining) on the basis of need and the number of jobs created.

Luttrell (1972) suggested that an industrial complex type pole plan is suitable for Canada's Atlantic provinces. He says the 'complex' approach is advantageous because it combines the propulsive industry notion, and ii) a geographical concentration of economic units.[10] Furthermore it should reduce the time needed for the project to grow of itself. He makes good use of the elements of functional and spatial inter-relatedness by suggesting that two spatial poles be located, one each in Halifax and St. John, but that they operate as a functional unit (i.e., no duplication of effort but complimentary investment in each).

It is mildly encouraging that one of the areas for contention in pole theory (i.e., geographic polarization versus polarization in abstract economic space) has been rationalized and used to the planners' advantage.

---

10 The complex approach refers to the aggregation of several firms in one place. While individual firms may not provide the impulse needed to create a growth pole an integrated complex of firms may be able to rapidly achieve the linkages, external and internal economies of scale and rate of growth needed to be able to call a city a growth pole. The diversity of such a project increases its chances of success.

CHAPTER THREE - METHODOLOGY

This chapter describes the development of the methodology which we propose to use to detect and describe pole-hinterland relationships. The method will be applied to two of Canada's 'natural poles', Halifax-Dartmouth and Quebec City. Conclusions and observations with regards to their impact and past and future effectiveness as growth poles will then be offered.

Growth pole literature leads us to believe that the effect of a pole on its hinterland should decrease with distance away from the pole. We also expect that there exists a significant time dimension in this relationship. Our goal is to develop a model that will describe this relationship if it in fact exists. Within the following few pages are described two models which were designed to model the time and space dimensions of economic growth (Casetti, King and Odland, 1971; Casetti, King and Williams, 1972). On the basis of the experience reported in those two papers we determined that a methodology developed by Casetti (1973) for describing spatial-temporal trends in urban population density may be appropriate for growth pole analysis, i.e., to describe the distance-time dimension of a pole's impact. Modifications were necessary but the basis of our model comes from Casetti's (1973) approach.

Casetti, King and Odland (1971) developed a method of testing for the existance of single or multiple growth poles in geographic space.

They define Z(x,y,t) as the intensity of some phenomena at a location with co-ordinates (x,y) at time (t). They state that the procedure for testing multi-polar hypotheses is not difficult and poses no conceptual problems. The model:

(1) $Z(s,t) = a_0 + a_1 t + a_2 s + a_3 st$

where:

$Z(s,t)$ = the intensity of some phenomena at distance s from the pole at time t,

a_0, a_1, a_2, a_3 = parameters to be estimated.

is estimated with a stepwise regression. Polarized growth occurs when the conditions:

(2) $\frac{\partial z}{\partial t} = a_1 + a_2 s > 0$ and

(3) $\frac{\partial^2 z}{\partial_t \partial_s} = a_s < 0$ are met.

A best fit was defined as the step in the regression at which all coefficients were significantly different from zero at the 5% level. Their empirical test confirmed the polarization of growth around Los Angeles.[1]

---

[1] The R^2 in this example was 0.69.

Casetti, King and Williams (1972) formulated a regression model to explain the diffusion of economic development away from London, England through the years 1860 to 1913. Using Casetti's (1972a) expansion method they expanded (4) by a time dimension:

$$(4) \qquad y(s) = \exp(a_0 + b_1 s)$$

where:

y = per capita income at a distance s from London

s = distance from London

a_0, b_1 = parameters to be estimated.

The expanded model for which they estimated the coefficients was:

$$(5) \qquad y(s_1 t) = v + \exp(a_0 + a_1 s + b_0 t + b_1 st)$$

where:

v = arbitrary constant

t = time.

A best fit was defined using the criterium of Casetti, King and Odland (1971).[2] The state that the implicit partial derivative of distance (s) with respect to time (t) will yield an estimate of the velocity of the spatial spread of growth.[3]

---

[2] The R^2 value was 0.848.

[3] In their case the velocity of spread was estimated at 21 km per year.

Because growth takes place in economic as well as geographic space we feel that the velocity estimate may not be able to be directly interpreted as the rate of development diffusion. Casetti, King and Williams (1972) did demonstrate that the diffusion of growth about a pole can be described using a model which includes time and space variables.

In this research report we will use a regression model similar in form to the above two but most directly related to Casetti's (1973) time expansion of Newling's density decay model. Casetti hypothesised that the relationship of density and distance changes over time. Newling's model can be written as:

$$(6) \qquad D(s) = \exp(a + bs + cs^2)$$

where:

$D(s)$ = population density at distance (s) from the C.B.D.

a, b, c = parameters to be estimated.

Casetti expanded the coefficients of Newling's model (6) into a function of time. He suggested that the coefficients can be redefined as follows:

$$(7) \qquad a = a(t) = a(a_0, a_1, t) ,$$

$$(8) \qquad b = b(t) = b(b_0, b_1, t) ,$$

$$(9) \qquad c = c(t) = c(c_0, c_1, t) .$$

Casetti suggested that the minimum number of terms sufficient for the identification of the spatial-temporal trends under investigation should not be exceeded.[4] Because the sufficient conditions for the four trends involve restrictions on coefficients a, b, and c and their first derivatives with respect to time he said only polynomial expansions up to linear terms should be used. Therefore he suggested the following expansions:

$$(10) \qquad a = a_0 + a_1 t \quad ,$$

$$(11) \qquad b = b_0 + b_1 t \quad ,$$

$$(12) \qquad c = c_0 + c_1 t \quad .$$

By substituting (10), (11) and (12) into (6) the model becomes:

$$(13) \qquad D(s,t) = \exp(a_0 + a_1 t + b_0 s + b_1 st + c_0 s^2 + c_1 s^2 t)$$

where:

t = time.

We chose (13) as the functional form to test the hypothesis that values of our dependent variable, occupations per person, will generally be

---

4 He was concerned with four general trends: i) overall density increase in the region with the maintenance of a cone shaped density gradient, ii) flattening of a cone shaped density surface, iii) transition from a density cone to crater and iv) a widening of a density crater.

larger close to the pole and tend to decline with distance from the pole. The hinterland should react in kind to the economic trends in the pole; the areas closest to the pole being most responsive to pole activity.

THE MODEL USED IN THIS REPORT

With the inclusion of our dependent variable the model becomes:

$$(14) \quad \text{Occupations per Person } (s,t) = \exp(a_0 + a_1 t + b_0 s + b_1 st + c_0 s^2 + c_1 s^2 t).$$

The model was further modified in two ways. In the first case the term $b_1 st$ was again expanded by a time dimension. We did this because neither the partial derivatives of the dependent variable with respect to time or distance (from (13)) indicated how the association between the change in the dependent variable and time alters as time itself changes. Let us be more explicit. Consider that:

$$(15) \quad \frac{\partial \text{ Occupations per Person}}{\partial s} = \exp(a_0 + a_1 t + b_0 s + b_1 st + c_0 s^2 + c_1 s^2 t)(b_0 + b_1 t + 2c_0 s + 2c_1 st).$$

From (15) above it is evident that the change in the level of the dependent variable with respect to distance is a function of distance (s) and time (t). But:

$$(16) \quad \frac{\partial \text{ Occupations per Person}}{\partial t} = \exp(a_0 + a_1 t + b_0 s + b_1 st + c_0 s^2 + c_1 s^2 t)\ (a_1 + b_1 s + c_1 s^2)$$

implies that the change od dependent variable with respect to time is solely a function of distance (s); the time dimension has been left out. We should also be interested in how the dependent variable's relationship to time (t) changes as time (t) itself changes at a given distance (s). To achieve the inclusion of the appropriate time dimension the expansion of $b_1 st$ by a time factor is required. Hence:

$$(17) \quad b_1 = b_1(t) = b_1(b_0' , b_1' t) \ .$$

The following expansion is indicated:

$$(18) \quad b_1 = b_0' + b_1' t \ .$$

The regression model to be used for the analysis of a pole's impact becomes:

$$(19) \quad \text{Occupation per Person} = \exp(a_0 + a_1 t + b_0 s + b_1' st + b_1' st^2 + c_0 s^2 + c_1 s^2 t) \ .$$

Now the partial derivative with respect to distance (s) describes the change in the relationship of the dependent variable with respect to

distance (s) as a function of distance (s) and time (t) and the partial derivative with respect to time (t) also describes the change in the dependent variable with respect to time (t) as a function of distance (s) and time (t).

Secondly, a dummy variable was added to the Halifax-Dartmouth model to account for differences in cities within 50 miles of the Nova Scotia-New Brunswick border which may be more closely linked to Moncton, New Brunswick than Halifax. The Quebec City model had the distance from Montreal added as an independent variable to account for the impact of Montreal.

The complete model for the Halifax-Dartmouth case study becomes:

$$(20) \quad O/P(s,t) = \exp(a_0 + a_1 t + b_0 s + b_1' st + b_1 st^2 + c_0 s^2 + c_1 s^2 t + d)$$

where:

d = dummy variable, distance less than 50 miles from the Nova Scotia-New Brunswick border,

and for Quebec City:

$$(21) \quad O/P(s,t) = \exp(a_0 + a_1 t + b_0 s + b_1' st + b_1' st^2 + c_0 s^2 + c_1 s^2 t + d)$$

where:

d = distance to Montreal.

We expect these models to provide a description of dependent variable

levels around the poles for the time periods 1941, 51, 61, and 1971.

To examine for variations in the effect, importance and viability of specific occupations in different size cities a one way analysis of variance and a simple correlation analysis on total occupation growth rates and its eight sub-divisions for three city population size groups (less than 2000, between 2000 and 5000, and greater than 5000) was performed.

CHAPTER FOUR - THE HALIFAX-DARTMOUTH POLE REGION

The Halifax-Dartmouth pole region was chosen as an area for study because present policy initiatives indicate that the Halifax-Dartmouth urban area is intended to be a focus of investment and development for its region. In 1971 their combined population was 186,865. The combined cities create the largest urban agglomeration in Nova Scotia; Sydney being the next largest city with a 1971 population of 33,230. Halifax is the capital of a province which has traditionally lagged (in the economic sense) behind most of Canada.

For this study we considered the whole province of Nova Scotia as the hinterland of the Halifax-Dartmouth pole. This is not unreasonable since the Halifax-Dartmouth complex is so large compared to other cites in the region.[1] We expect it to act as a development pole for its region; that is, it should undergo self-sustaining development and generate growth impulses which the cities in its hinterland will grow in response to. At the very least it should be able to pick up growth and development impulses that move across and down the national urban hierarchy.[2] Hopefully the pole would grow in

---

[1] In 1941,31.00% of the urban population (those living in cities with populations of 1000 or over) lived in Halifax-Dartmouth, in 1951, 33.85%; in 196., 40.51% and in 1971 the percentage was 47.59%.

[2] In other words we expect the pole city to have an intimate relationship with national economic trends.

response to the national trends and then diffuse pole related growth trends outward into its own hierachy of cities; a hierarchy which, due to its low order in the national urban system, might otherwise not be in the mainstream of national economic activity.

DATA SOURCES

The decennial Canadian Occupation Census for 1941, 1951, 1961 and 1971 was used as the data source. Statistics on the experienced labour force in all villages, towns and cities with a population of 1000 or over were collected. People looking for their first job were not included in the experienced labour force. In the occupations census each person was asked his or her present or last occupation. Changes in the format over the four censuses did not allow the separation of the employed from unemployed in each occupation.

Total occupations and occupation in eight sub-groups were recorded for each town.[3] Due to changes in the classification scheme Construction and Labourers occupations had to be left out because appropriate aggregations and deletions could not be made in order to maintain comparability between censuses.

CHOICE OF THE DEPENDENT VARIABLE

Beside the dependent variable "occupations per person" two other

---

[3] The eight sub-groups are Agricultural, Other Primary (mining, quarrying, hunting, fishing and trapping), Manufacturing and Mechanical, Transportation and Communication, Professional, Service and Recreation, Retail Trade and Finance and Clerical occupations.

versions of the dependent variable were experimented with. The "occupation growth rate" and "per capita occupation growth rate" of the cities were each regressed against the independent variables of the regression model. Neither dependent variable yielded acceptable results. With the dependent variables "total occupation growth rate" and "total occupations per person growth rate" the R^2's were 0.1167 and 0.0205 respectively, each with very high standard errors.[4] These forms of the dependent variables were dropped from consideration at this time. In a later chapter suggestions will be made regarding their possible compatibility (in modified form) with a model of the type used in this report.

One other experiment was made. "Total occupations per person" was regressed with Halifax-Dartmouth included as observations and once with them deleted. In the first instance a sharp peak developed at distance 0.0 and in the second the curve was more plateau like and then developed a negative slope as distance from the pole increased (see figure 4-1). The inclusion of Halifax-Dartmouth introduced a spurious relationship into the model that over emphasized the peak in the level of the dependent variable near the pole. The model with Halifax-Dartmouth deleted provided a more suitable description of the effect of the pole on its hinterland, even though the R^2 was reduced to 0.2762 from 0.4022. Inclusion of the pole would make it too easy to conclude that there was a polarization of growth around the pole. No other data

---

[4] On average the observed dependent variable value was approximately plus or minus 700% of the values predicted by the regression line.

points besides Halifax-Dartmouth lie within 30 miles of the pole, therefore this is no evidence to support or contradict the existence of such a negative sloped peak in the 0.0 to 30.0 mile zone and its decay over distance. We concluded that modelling the hinterland provided a more rigourous examination of the effect of the pole.[5]

RESULTS OF THE ANALYSIS

The following two sections report the results of the stepwise regression analysis, analysis of variance and correlation analysis. Nine regression analyses were done, one for each occupation class. The form of the regression equation was judged significant if the overall regression was significant at the 5% level and if all coefficients were significantly different from zero at the 20% level. Of those equations which met the above conditions, that with the largest R^2 was selected for use. The statistical results are displayed in table 4-1.

---

[5] Data points for the Halifax model lie between 30 and 210 miles from the pole. It would not be proper to allow two points at distance 0.0 and 3.0 miles to inordinately affect the regression. Hence, all figures will have the estimated regression line truncated at 30 miles. The line associated with the inclusion of the dummy variable will be truncated at 60 miles and 115 miles, i.e. 50 miles from the New Brunswick border. A value of '1' indicated the city was within 50 miles of the border and '0' indicated it was not so located.

To provide a feel for the temporal activity of the dependent variable in the pole the data points for Halifax and Dartmouth will be marked on figures 4-1 throughout 4-9, although they have not been included in the regression.

OUTPUT OF THE REGRESSION MODEL

The next nine sub-sections summarize the findings of the regression analysis as applied to total occupations per person and the eight occupational sub-groups.

Dependent Variable: Total Occupations Per Person.- Total occupations per person (figure 4-1) tended to decline from 1941 to 1971. This marked an increase in the number of persons supported by each job and implies a reduction in welfare levels. Beyond a range of 180 miles the situation began to reverse itself in 1961, a trend which continued until 1971. We suspect this is due to the provincial takeover of the Sydney Steel complex and an associated increase in capital investment in the early 1960's and to the strength of Yarmouth as a fishing port. Theoretically the welfare levels in localities near Sydney and Yarmouth would grow also. A word of caution; all cities in Nova Scotia, regardless of their compass direction from Halifax-Dartmouth, were plotted on the same distance axis. Therefore our conclusion regarding Sydney and Yarmouth must be guarded as we are dealing with a uni-directional and two dimensional surface, not a three dimensional surface where each city would have a unique distance and direction vector relative to the pole.

The Halifax-Dartmouth data points indicate that over time there has been an increasing growth in and polarization of per capita occupations levels in the pole. This is especially significant when we consider the rapid population growth rate Halifax-Dartmouth has

TABLE 4-1

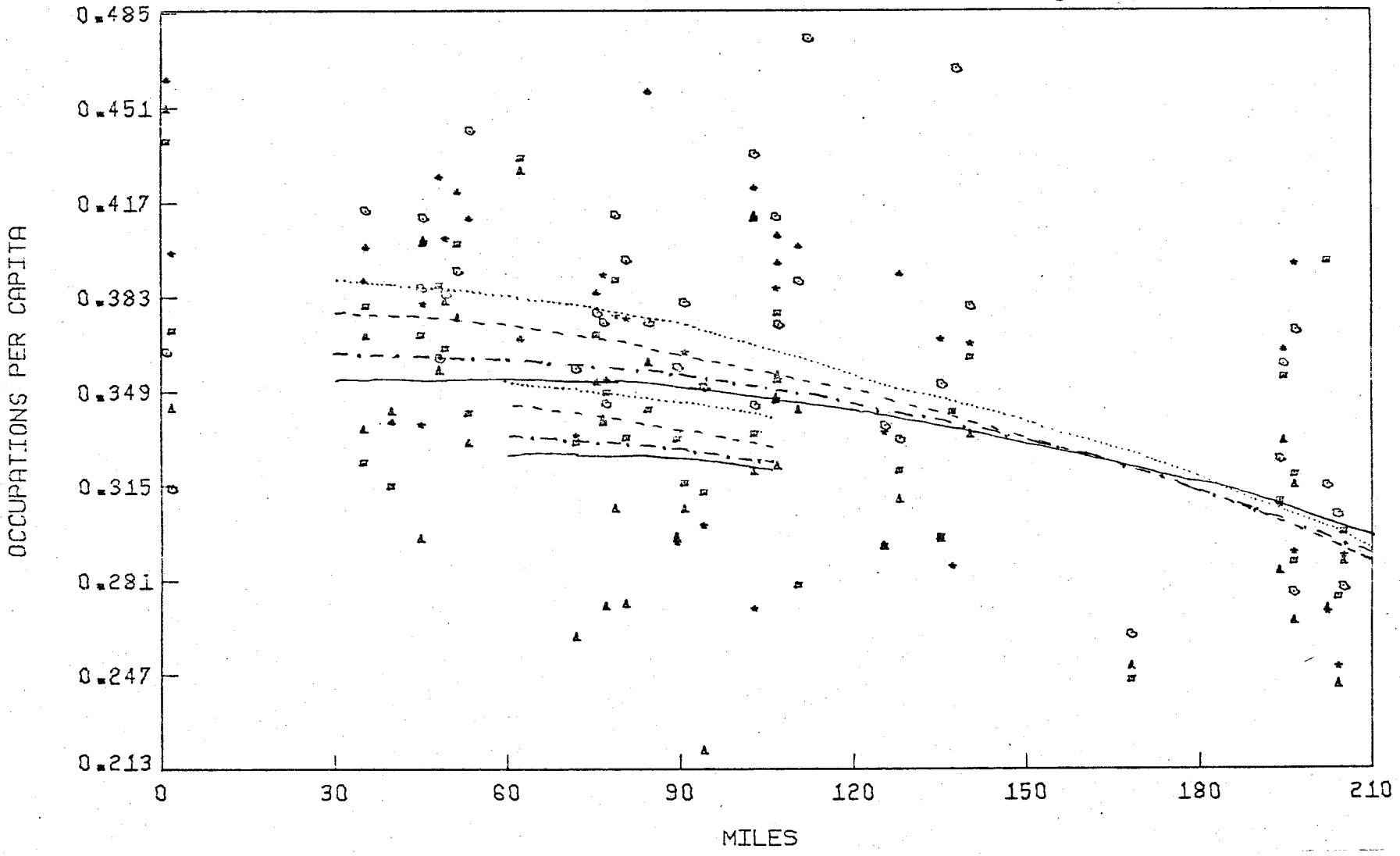
Regression Output for the Halifax-Dartmouth Region

Dependent Var.				Regression Coefficient*							
Per Capita Occupations	R^2	Std. Error**	Reg'n Signif	Constant	t	s	st	st^2	s^2	s^2t	dummy
Total Occupations	0.2762	13.6%	>0.00001	-0.89558	-0.03843	-	-	0.00004	-0.00001	-	-0.07811
Agricultural	0.2895	155	>0.00001	-3.86901	-	-	-0.01525	0.00195	0.00002	-	0.65376
Other Primary	0.2409	340	>0.00001	-6.01451	-	-0.00225	-	-	-	-	-
Manufacturing & Mechanical	0.2088	67	>0.00001	-3.02275	0.16574	-0.00333	-	-	-	-	-
Transportation and Communication	0.2288	68	>0.00001	-2.81483	-0.36414	-	0.00127	-	-0.00002	-	-0.26685
Professional	0.2957	58	>0.00001	-3.39203	0.10031	-0.00445	-	0.00017	-	-	-0.22895
Service & Recreation	0.3012	42	>0.00001	-3.05816	-	0.00706	-0.00402	0.00086	-0.00003	-	-0.22800
Retail Trade & Finance	0.1700	49	0.00003	-2.94760	0.12818	-0.00184	-	-0.00016	-	-	-
Clerical	0.4359	51	>0.00001	-3.85789	0.25794	-0.00346	-	-	-	-	-0.27928

*The coefficients have not been standardized.

**As a percentage $\pm$ the predicted value of the dependent variable.

FIGURE 4-1: Total Occupations; The Halifax-Dartmouth Region



experienced versus the slow growth or decline of most other cities.[6] Rapid population growth should tend to hold down the value of the dependent variable. In the hinterland absolute population growth generally outstripped the growth in occupations or at least the decline in occupations was larger than the population decline.

The level of the dependent variable was consistently lower for the area affected by the dummy variable (hereafter referred to as the panhandle). Apparently this area is out of the mainstream of the Nova Scotian economy.[7] It has traditionally been an agriculturally based area with few other major economic activities (cf. figure 4-2).

Even considering the relatively low R^2 and relatively high standard error the very high level of regression significance suggests that the trends depicted in figure 4-1 did exist. But our conclusions must be considered with care; they indicate trends and do not purport to predict future activity.

Dependent Variable: Agricultural Occupations Per Person.- Figure 2 describes the general decline per capita agricultural occupations have experienced in Nova Scotia. Alhtough the R^2 is larger than for the regression of total occupation per person the standard error is also much larger. The regression is highly significant and we can conclude that a general downward trend does exist. The reduction is probably due to a

---

6 For example, the 1941-51, 1951-61 and 1961-71 population growth rates for Halifax-Dartmouth were 23.7%, 38.6% and 33.9% compared with Sydney's 10.6%, 7.3% and -1.1%.

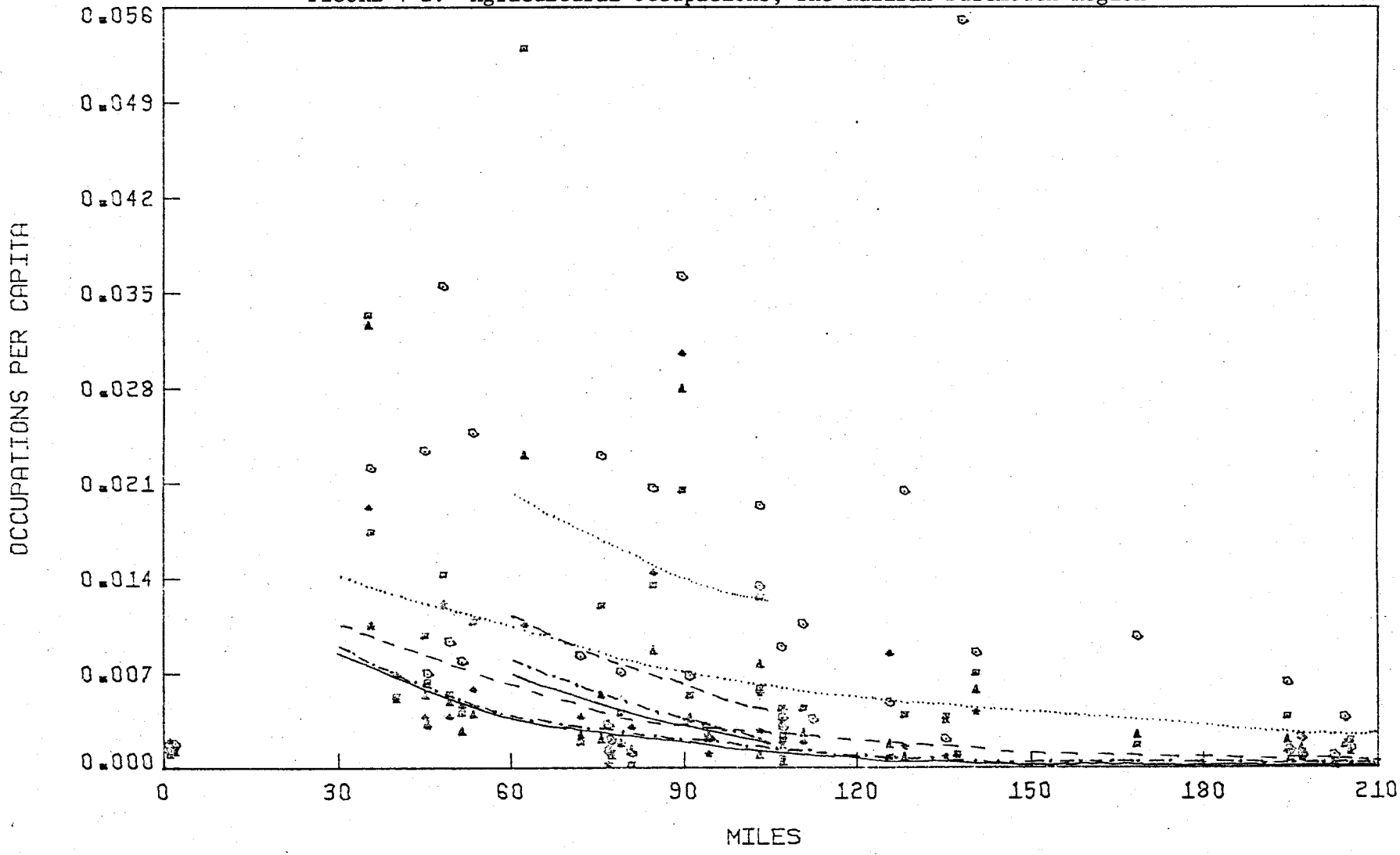
7 The model was also run with the dummy variable deleted. Residuals for the townsin the panhandle were consistently higher. We concluded that the 'dummy' did account for a phenomena specific to the panhandle.

reduced demand for farm labour with developments in technology and a cessation of production in favour of more fertile and economic areas closer to the main regional markets.

The slowdown of the decline by about 1961 suggests that a base level has been reached. Per capita occupations in agriculture survived best in areas adjacent to the pole (less than 90 miles away). Agricultural occupations per person was the only dependent variable that had a positive coefficient on the dummy variable. This supports our earlier conclusion that the panhandle was oriented primarily to agriculture. It is not immediately clear if the extremely low occupation levels beyond 90 miles are due to a lack of market or poor physical conditions. We suspect that a combination of relatively poor conditions and the growing ability for the Halifax-Darmouth market to be served by imports and from areas adjacent to the pole combined to produce the trend. As one would expect, agricultural occupations in the pole were practically non-existent.

Dependent Variable: Other Primary Occupations Per Person.- Given the appropriate consideration of the R^2, standard error and significance level about all that can be said is that a decline has occurred over time (see figure 4-3). Within 90 miles of the pole a base level had been reached by 1941. The regression line at more extreme distances is dominated by Yarmouth, Digby, Sydney, Sydney Mines and New Waterford where mining, material handling and fishing are substantial elements of their occupational structures. A downward trend began in 1941 but attenuated until it appeared a base level was being reached in 1971. The pole has

FIGURE 4-2: Agricultural Occupations; The Halifax-Dartmouth Region



has apparently not been a dominant source of growth impulses: national and regional demand probably support the primary occupations in the above mentioned centres.

Dependent Variable: Manufacturing and Mechanical Occupations Per Person.- Per capita Manufacturing and Mechanical occupations (figure 4-4) experienced general growth in Nova Scotia. The R^2 and significance level led us to believe that a trend of this general form did exist.

Percentage growth of the dependent variable over 30 years appeared to be largest (63%) in a ring 30 to 75 miles from the pole. The pole itself showed gains until 1951 and then sharp losses to 1971. Apparently overall growth in the pole and other major cities has been sufficient to support an expanded Manufacturing and Mechanical sector. The slightly stronger 30 year growth adjacent to the pole (63% at 30 miles versus 57% at 210 miles) suggests that the rapid population growth of the pole (from 1941-61) has helped generate greater demand close to the pole rather than in other more distant parts of the province. However, there is no immediate evidence to suggest that the pole caused the province-wide per capita increase in this occupation class. The eveness of the provincial growth suggests that some other influence may have been at work, eg. a national trend or change in technology and consumer demands which had a blanket effect on all cities. This conclusion is supported by the fact that the pole did not show any definite Manufacturing and Mechanical growth trend, 1951-61 experienced a decline while provincial levels continued to grow.

FIGURE 4-3: Other Primary Occupations; The Halifax-Dartmouth Region

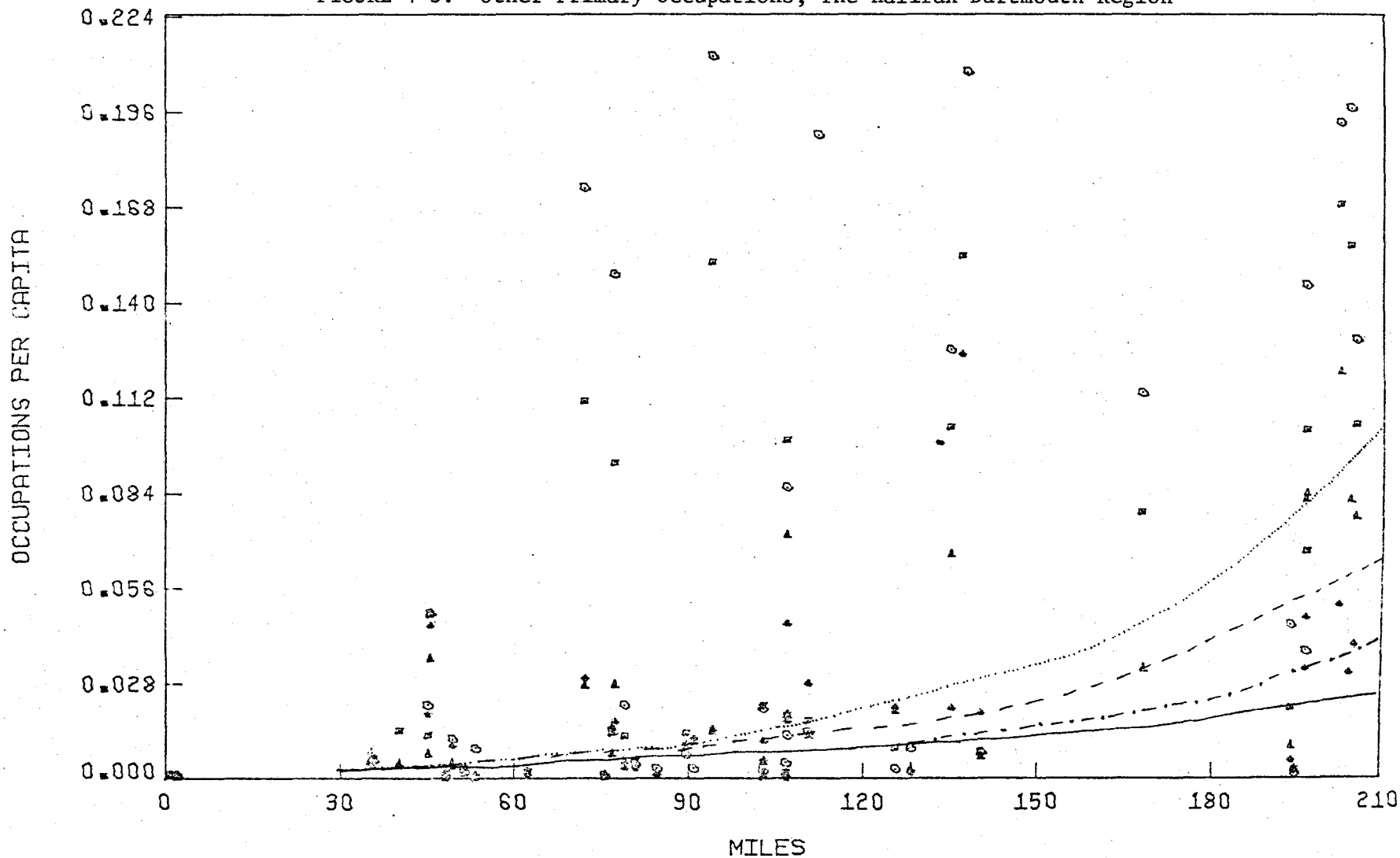
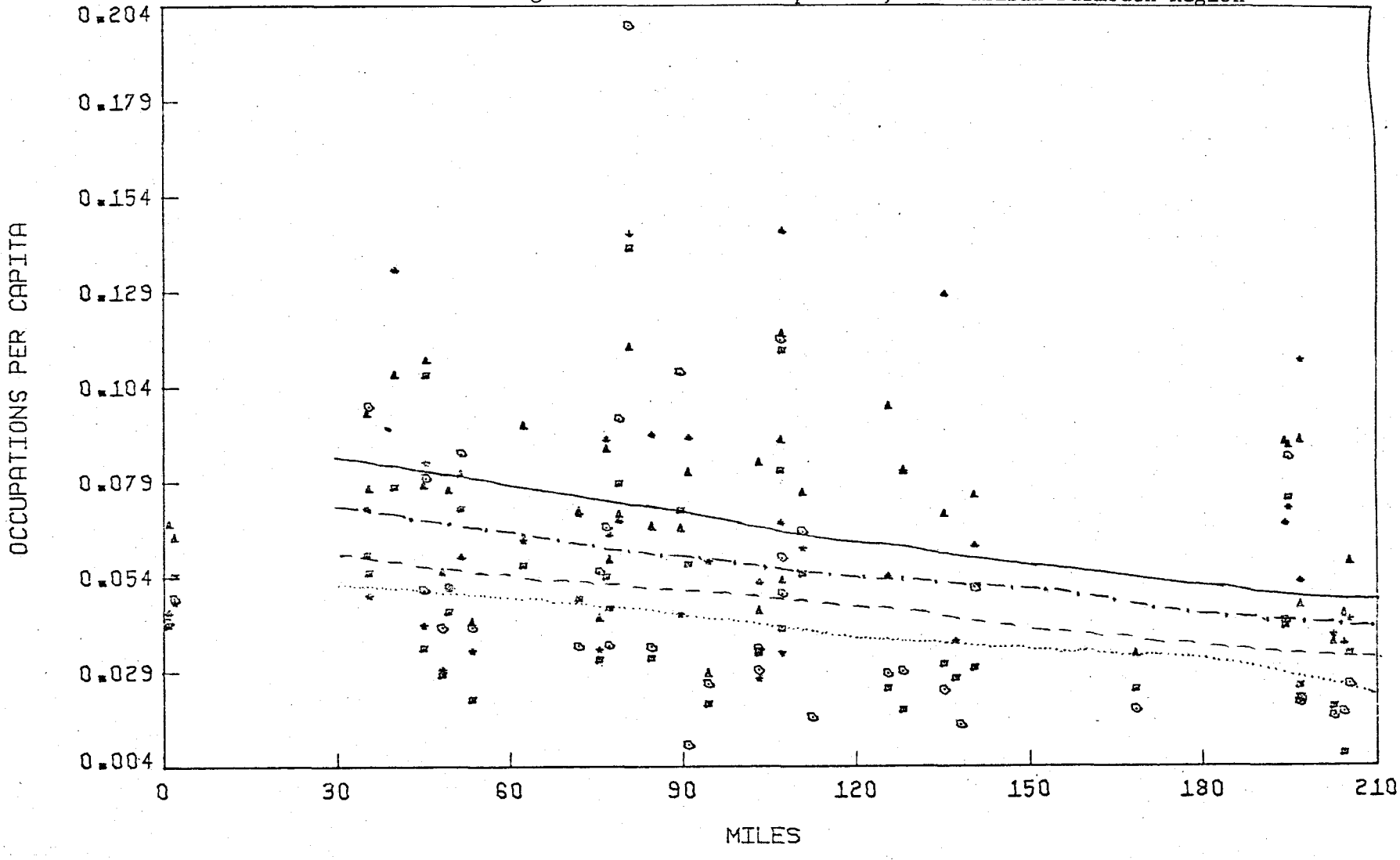


FIGURE 4-4: Manufacturing and Mechanical Occupations; The Halifax-Darmouth Region



o = 1941 observations
∅ = 1951 "
Δ = 1961 "
* = 1971 "

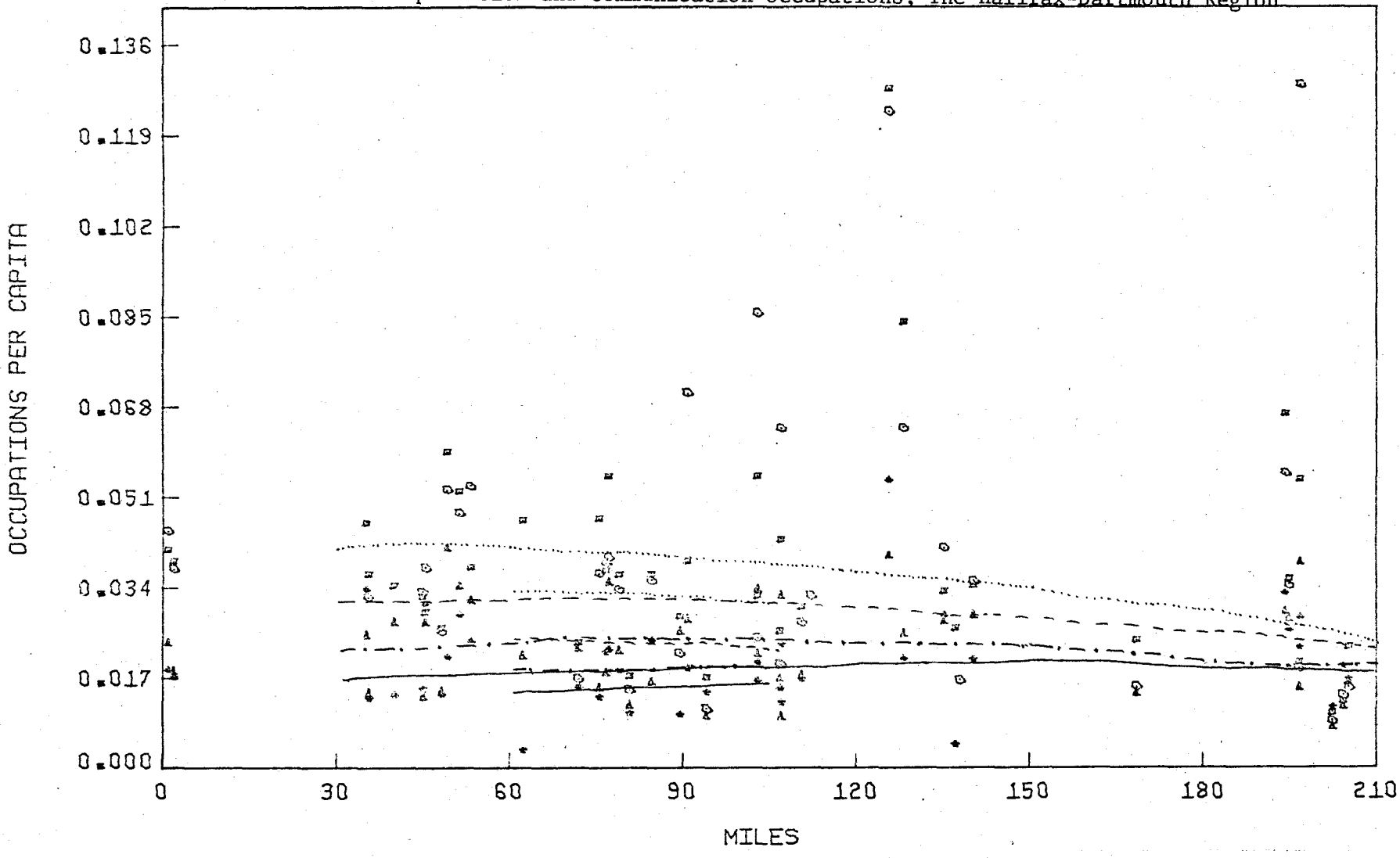
..... = 1941 regression line
– – – – = 1951 " "
–·–·–·– = 1961 " "
——— = 1971

Dependent Variable: Transportation and Communication Occupations Per Person.- The statistical results were comparable to the Manufacturing and Mechanical results, but in contrast there was a 30 years decline in Transportation and Communication occupations per person (figure 4-5). Towards 1971 the descent slowed. Thirty miles from the pole the 30 year loss was 36% versus 9% at 210 miles. Data points at the pole indicated a reduction in levels in the pole but they remained marginally higher than hinterland values. We expected an increase near the pole in Transportation and Communication occupations per person, an occupation class that should be tied to the infrastructure of a growing area. At this early stage of analysis the reduction could be explained by the introduction of improved technology requiring less labour or allowing a more intense use of present facilities. On the surface figure 4-5 suggests a weakening in part of the regional infrastructure.

Dependent Variable: Professional Occupations Per Person.- Professional occupations per person (figure 4-6) have experienced a general upswing in the 30 year period, even the panhandle showed growth, although at reduced levels. Growth in the dependent variable near the pole approached 45% for the 30 year period and extreme distances had a 65% increase.

It appears that the region has undergone a region wide increase in the demand for and ability to support more Professional services per person (eg., doctors, lawyers, teachers, government administrators). The improvement is encouraging because it indicates a growing investment in both human capital and administrative services. Growth in this occupation class probably helps improve the social and economic

FIGURE 4-5: Transportation and Communication Occupations: The Halifax-Dartmouth Region



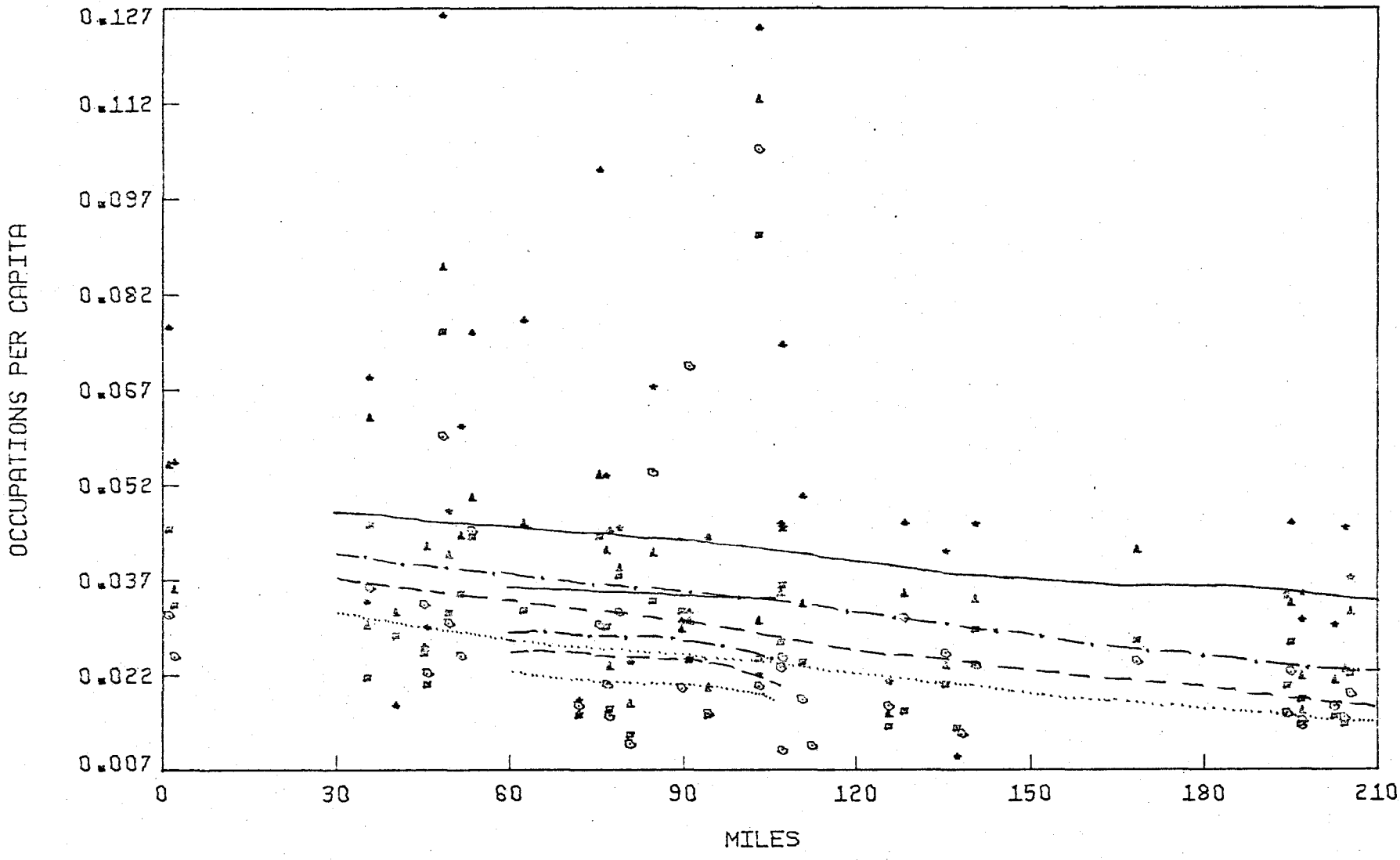
infrastructure of the region.

Thirty year growth levels tended to be larger as the distance from the pole increased. Decennial growth appeared to step up as 1971 approached. An influx of Professional occupations leads us to suspect that this generally better educated and more mobile class has some faith in the region's potential. The pole itself lagged in Professional occupation per person until 1961 at which time occupations per person levels sky rocketed. This exhibition of growing strength in the pole probably had a beneficial qualitative and quantitative impact on the hinterland's performance.

Dependent Variable: Service and Recreational Occupation Per Person.- Service and Recreation occupations per person (figure 4-7) expansion appeared to be focused on the hinterland but during the province wide decline from 1941 to 1951 pole levels continuedto grow. Magnitudes of percentage decline (1941-51) and growth (1951-71) increased with distance (beyond 30 miles) and then leveled out at about 90 miles. In the 90 to 210 mile ring there was approximately a 39% decline from 1941 to 1951 and an increase of 58% from 1951 to 1971 (most of which took place from 1961-71) for an overall 30 year growth of about 14%. Levels of per capita occupation tended to peak at 90 miles from the pole and then declined. The panhandle followed a similar growth pattern.

Considering the tourism potential of the region we expected a consistent upward trend. Tourism itself does not create as many jobs as it brings money into the region. The increased money inflow is probably reflected in a concomitant rise in service occupations per

FIGURE 4-6: Professional Occupations; The Halifax-Dartmouth Region

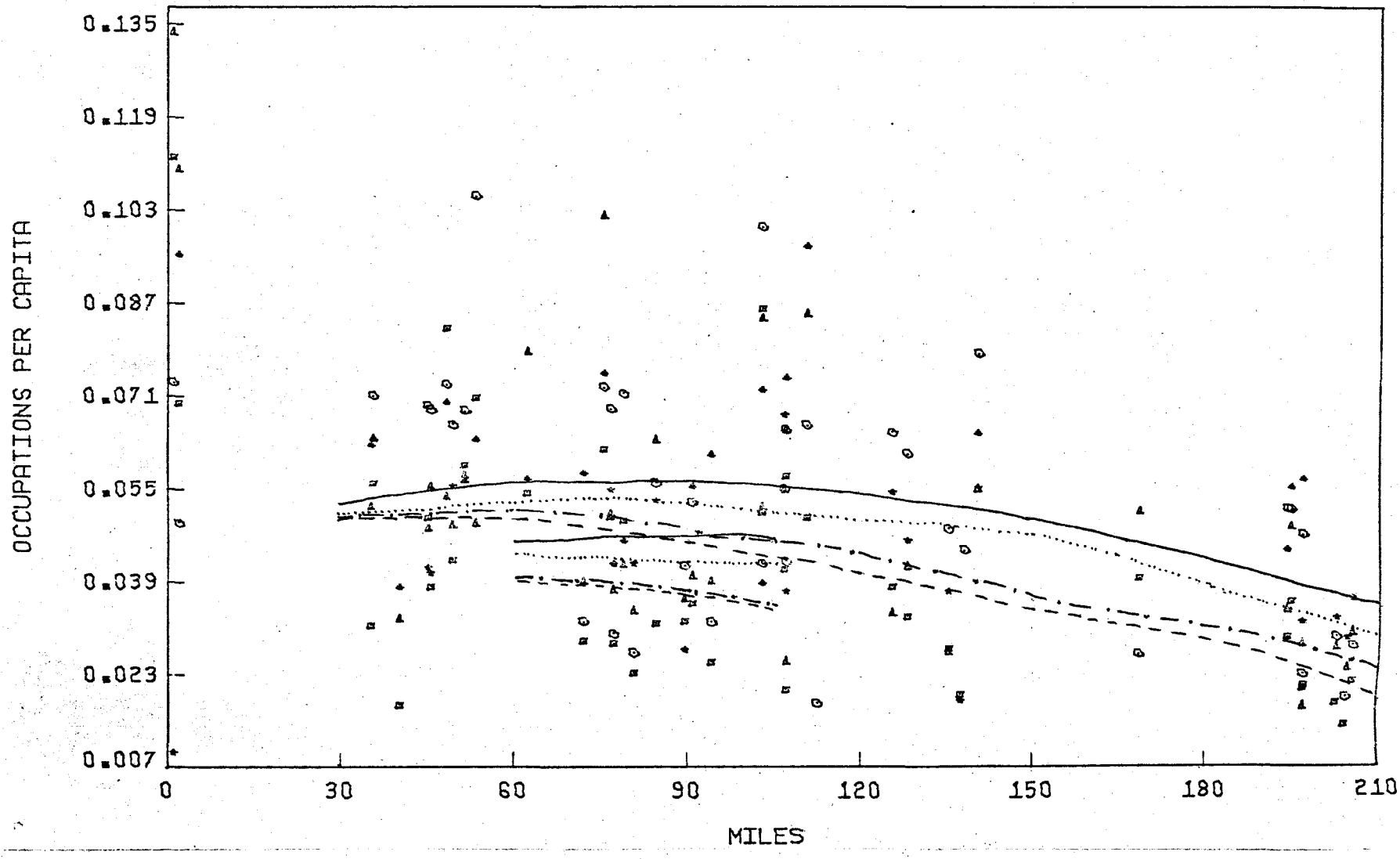


person (ie. services purchased by resident households). 1961 marked the start of a surge. A rise in the service component of this occupation class would indicate an improvement in the quality of life in the region and an advancement in the ability of the regional economy to support an expansion in an ancillary service sector. The rapid growth and higher per capita levels within 90 miles of the pole probably indicate the beneficial impact of proximity to the pole. We suspect that per capita service occupations are supported in the pole by the large population increases and in the region and pole by the tourist trade.

Dependent Variable: Retail Trade and Finance Occupations Per Person.- Although the statistical results were not quite as good as the previous results the general trend described by the regression can be judged as significant. Retail Trade and Finance occupations per person (which includes managerial occupations) showed consistent growth (figure 4-8) each decade in locations near the pole (36% over 30 years). Beyond 120 miles from the pole the trend was mixed. 1941-51 had a 5% growth but 1951-71 showed a decline of up to 19% for an overall 30 year decline of up to 14% (at the 210 miles mark).

It appears that a version of Myrdal's backwash effect had taken hold beyond 120 miles. Even the relatively strong centres of Sydney, Sydney Mines, Yarmouth and Digby could not reverse the trend. It is interesting to note that values of the dependent variable in the pole tended to be lower than in cities adjacent to the pole. Halifax-Dartmouth did not exhibit the high growth suggested by a simple extrapolation of the regression line to the 'y' axis; instead growth has

FIGURE 4-7: Service and Recreation Occupations; The Halifax-Dartmouth Region



o = 1941 observations
□ = 1951 "
Δ = 1961 "
* = 1971 "

..... = 1941 regression line
– – – = 1951 " "
–·–·– = 1961 " "
——— = 1971 "

taken place in the 30-75 mile band around the pole. Relative to the adjacent 30-60 miles ring the pole does not appear to have as strong a Retail and Finance sector structure. At this time we see no obvious reason for the counter intuitive result. Population growth in excess of absolute growth in occupations and a more intense use of the existing Retail and Financial services appear to be the most obvious reasons.

Dependent Variable: Clerical Occupations Per Person.- Statistical results suggest that the trends did exist and that growth in per capita Clerical occupations (figure 4-9) accelerated with the passage of time. Thirty year growth near the pole was 117% and at 210 miles it was 118%. The panhandle reacted similarly. Levels of the dependent variable in the pole grew by about 60% over 30 years. If Clerical occupations were a sector that induced growth and development instead of responding to it the trends described would be most encouraging. The trend is encouraging to the extent that it indicates a general growth may have been taking place in the sectors that require clerical services. The previous dependent variables and their regressions do not conclusively point to the source of the growth in per capita Clerical occupations.

INFERENCES DRAWN FROM THE REGRESSION MODEL

The regression model described a more or less general decline in Total Occupations per Person over time and distance. Some individual regressions of occupation job classes described rising levels. A regression of Residual occupations per person (those occupations not

FIGURE 4-8: Retail Trade and Finance Occupations; The Halifax-Dartmouth Region

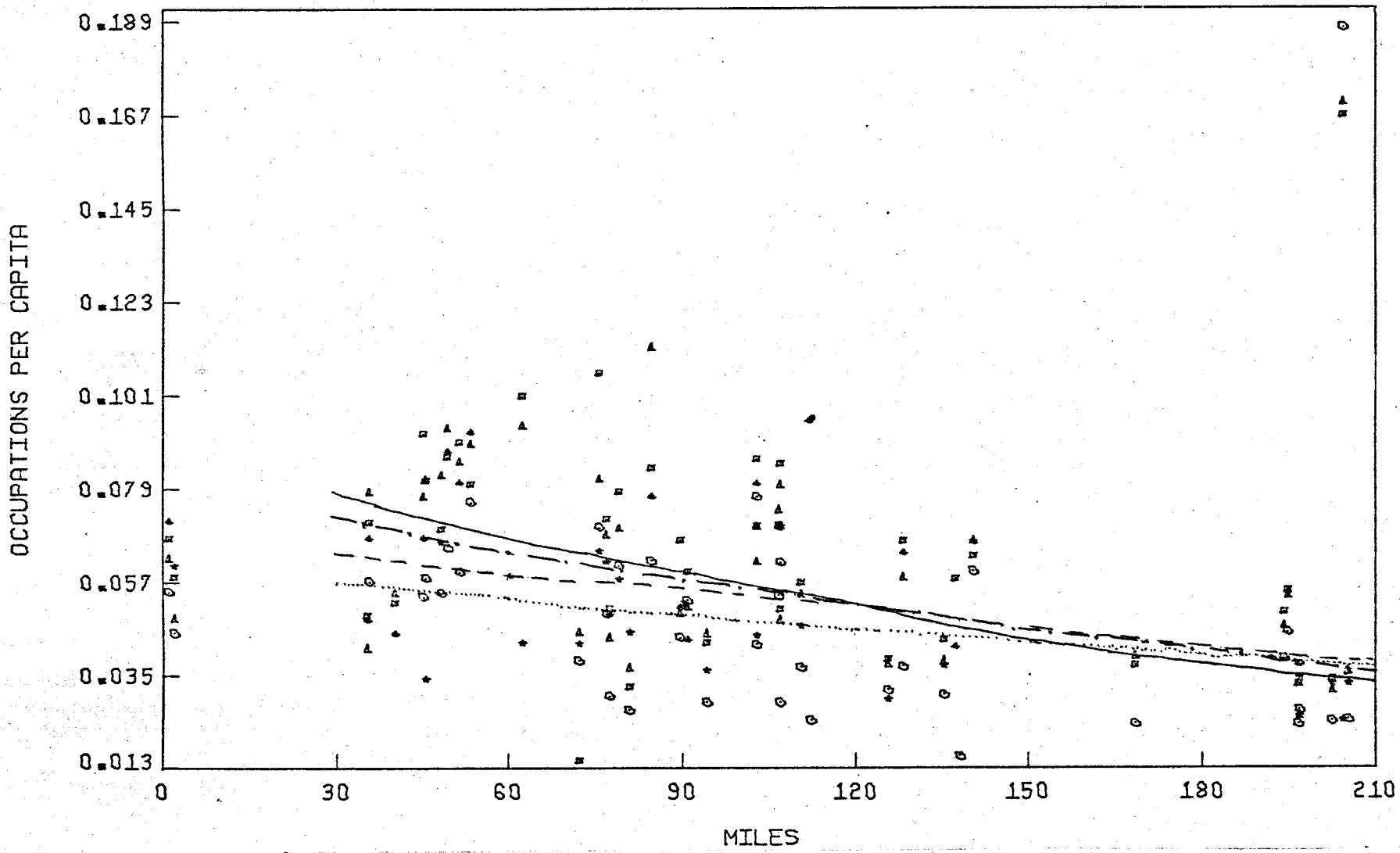
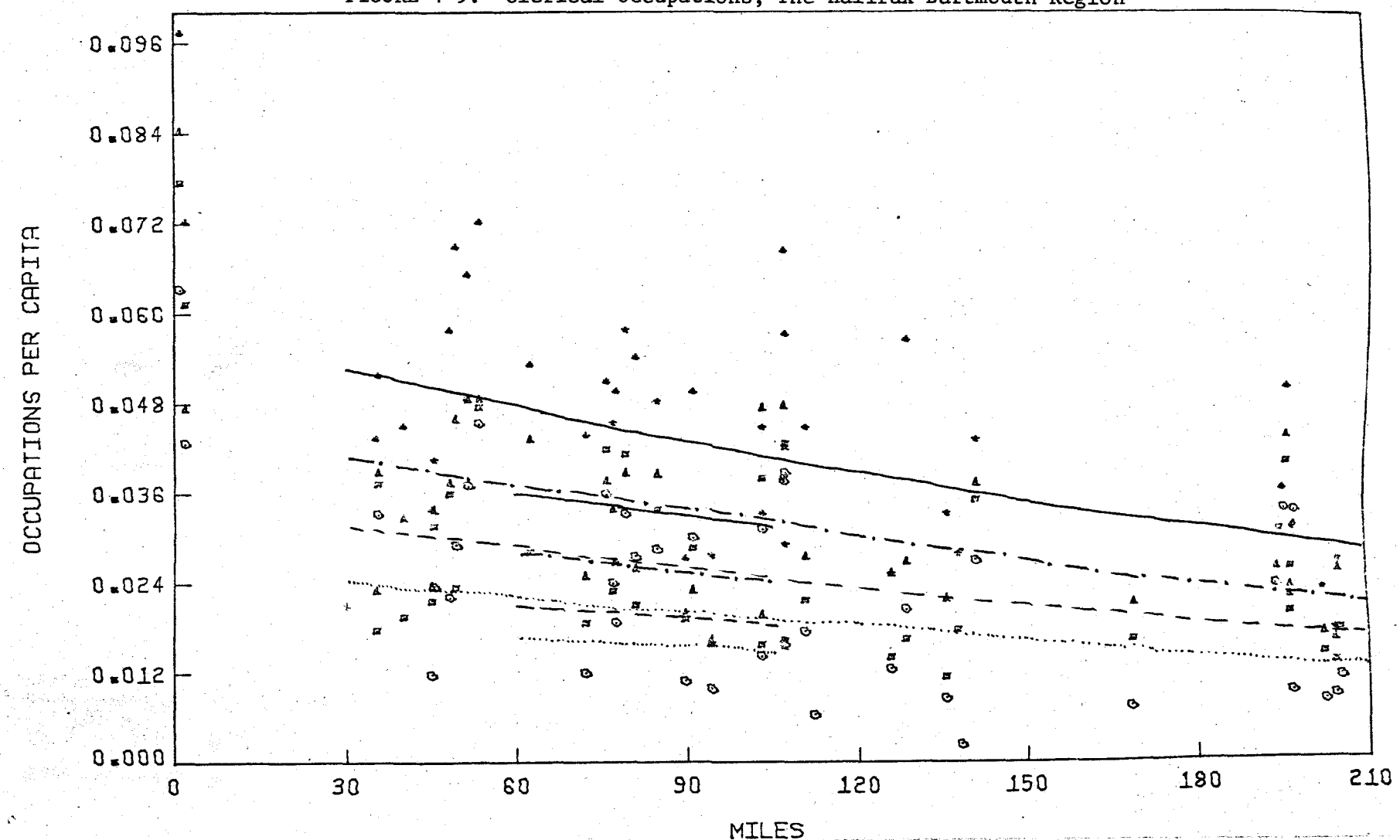


FIGURE 4-9: Clerical Occupations; The Halifax-Dartmouth Region



⊙ = 1941 observations
⊡ = 1951 "
◿ = 1961 "
* = 1971 "

..... = 1941 regression line
– – – – – = 1951 " "
–·–·–·– = 1961 " "
——— = 1971 " "

included in the eight sub-classes ie. labourers, construction workers and not specified) showed a declining trend over time.

Therefore we can suggest that while per capita levels of several occupation classes rose (ie., Manufacturing and Mechanical, Professional, Service and Recreation, and Clerical) the overall trend was down. Reductions in the per capita levels of Agricultural, Other Primary, Transportation and Communications, and Residual occupations appeared to cause the overall downturn. Apparently, it is these four occupation classes that need an economic policy that may help them grow. Such a policy would in the long run indirectly insure continued growth in presently growing occupation classes by supporting a segment of the regional economy that might otherwise have a deteriorating effect on the whole regional economy.

The regression model itself performed satisfactorily. In every case it yielded very high significance levels and managed to pick up trends existing in the data. Table 4-1 shows no significant differences in the occurance of the independent variables except for s^2t which never entered the stepwise regressions. The independent variable s^2t may not be suitable for the description of pole-hinterland relationships. The exact reason is not yet apparent.

ANALYSIS OF VARIANCE RESULTS

The poor results of the regression, when occupation growth rates and per capita occupation growth rates were used as the dependent variable, led us to suspect that in our case studies rates of change

were not strongly related to time and distance variables. Therefore we decided to test for the relationship of total occupation growth and growth in occupational groups for various city sizes. In other words; if growth rates did not vary according to distance and time then the next obvious relationship would be with size and the overall vitality of a city. We recognize that there is a degree of collinearity in regressing Total occupation growth rates against class occupation rates, especially if a particular class of occupations comprises a large part of the total occupation structure. The correlation analysis was a first step towards an analysis of responses to growth within the region as these responses vary by city size. But if an empirical basis of growth pole theory is to be built, growth rates of cities in the hinterland need to be explained in terms of their spatial, temporal and functional relationships to the pole as well as in terms of their own internal economic characteristics.

We have not explicitly met this need. It had to be approached in two parts, first by the examination of dependent variable levels in the hinterland and secondly by the analysis of variance and correlation analysis. The one-way analysis of variance and correlation analysis combined to provide a picture of occupation growth in each of three city size groups (population less than 2000, between 2000 and 5000 and greater than 5000).

City size classes were designated because economic growth theory suggests that size will influence both the growth rates and the economic sectors in which growth occurs. We hope to specify different responses to regional economic activity for different city sizes. Then we may be

better able to judge which places are potentially the most responsive to activity in the pole.

If the analysis of variance suggested a significant difference between the classes of occupation growth rates at the 5% confidence level the New Multiple Range Test (Duncan, 1955) was performed to identify which rates were larger than others (5% confidence level was enforced). A correlation analysis was performed on the decennial occupation growth rates of the three city size groups.[8] The correlation values will give some idea of how growth in the various occupation sectors is related to the over all occupation growth rate of a city.[9] For example, a strong positive relationship between growth in Clerical occupations and the Total occupation growth rate would suggest that Clerical occupations increase more quickly in rapidly growing centres. No relationship would suggest that growth occurs at random, possibly in response to some phenomena besides overall occupation growth.

CITY SIZE LESS THAN 2000

Mean occupation growth rates were calculated for each of the nine classes as listed in table 4-2. Table 4-3 shows the simple correlation values for Total occupation growth with its eight sub-groups.

---

[8] Note that these are growth rates of absolute number of occupations, not occupation per person growth rates.

[9] An r greater than 0.625 will be considered a strong relationship, between 0.500 and 0.625 moderate and less than 0.500 small (Haring and Lansbury, 1971, p. 69),and r must be significant at the 5% confidence level.

TABLE 4-2

Mean Occupation Growth Rates (%) for Towns with Populatio Less than 2000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	2.81	5.41	31.71
Agricultural	-33.58	-17.16	63.11
Other Primary	43.87	-8.01	5.79
Manufacturing and Mechanical	2.66	146.89	12.21
Transportation and Communication	8.66	-41.14	1.69
Professional	32.39	35.87	62.94
Service and Recreational	-18.38	41.75	41.34
Trade and Finance	65.68	-2.21	7.67
Clerical	37.46	41.43	81.29
Number of Observations	13	13	13

TABLE 4-3

Simple Correlation (r) of Total Occupation Growth Rates vs. Eight Sub-Groups for Towns with Population Less than 2000

	Total Occupation Growth Rates		
Occupation Sub-Group	1941-51	1951-61	1961-71
Agriculture	-0.306	-0.170	0.576*
Other Primary	0.090	0.076	0.034
Manufacturing and Mechanical	-0.113	0.435	0.781*
Transportation and Communication	0.392	0.177	0.700*
Professional	0.574*	0.669*	0.768*
Service and Recreational	0.652*	0.689*	0.594*
Trade and Finance	0.348	0.619*	0.920*
Clerical	0.374	0.459	0.944*

*Significance $\geq$ 5% level

1941-1951.- The analysis of variance indicated a significant difference among the growth rates. The NMRT indicated that during 1941-51 Trade and Finance, Other Primary, Clerical and Professional occupations experienced the highest average growth rates (between 65.65% and 32.39%) but also showed that their rates were not significantly different from each other.

Professional occupation growth rates showed a moderate positive relationship with Total occupation growth. Above average growth rates in the Professions tended to be linked to cities with overall local occupation growth rates exceeding 4.5%. As one would expect above average Professional occupation growth rates were associated with cities of above average overall occupation growth; in this case over 1.5 times the average. In other words Professions showed strong growth only the very quickly growing cities. Service and Recreation occupation growth showed a strong positive relationship to overall growth rates. The NMRT indicated its average growth rate to be one of the smallest,in fact the rate was negative (approx - 18.38%). Only cities with total occupation growth rates nine times greater than the average showed positive growth in this occupation class. This suggests that Service and Recreation occupations did not thrive in small towns. Wolfville, Middleton and Digby (of a total of 13) experienced decennial growth rates in Recreation and Service occupations of 34.0%, 9.5% and 8.5% respectively and experienced overall occupation growth from 1941-51 in excess of 25%. Outside of their growth rates the only other common factor is their location, along the Bay of Fundy. We suggest that these three towns

were the recepients of growth by virtue of their size (they are the three largest along the Bay) and location, hence possibly becoming early recipients of post WW II tourism growth. In general the Service and Recreation sector does not appear to have been an expanding and vital sector in small cities.

1951-1961.- Manufacturing and Mechanical occupations showed a 146.89% growth rate (vs. 2.6% for 1941-51). The NMRT indicated this rate to be the largest. Its relationship with the overall occupation growth rate for small towns was weak. Only two small cities of 13 had negative growth rates in Manufacturing related occupations. A post war boom may have encouraged this large blanket type increase. There is no self evident reason to expect that this growth was a direct reaction to growth in the pole but instead may have been a reaction to a general upward national trend. The next three largest rates were in Service and Recreational, Clerical and Professional occupations. Service trades growth rates had a strong positive relationship with overall growth rates (as in 1941-51). For 1951-61 they showed strong positive growth (41.75%) versus a negative growth rate for 1941-51.

Only 3 of 13 cities experienced negative growth in Service and Recreation occupation and as long as a locality had an above average Total Occupation growth rate it tended to experience above average rates of growth in Service and Recreation occupations. A national post war boom and increased travel and tourism may have been the cause. The pole probably helped these small towns achieve positive growth as it would be the focus of a national economic boom. Clerical growth rates still

showed no tendency to react in kind with overall growth. Only one small city had a negative rate growth in Clerical occupations. High clerical occupation growth was experienced even in towns with negative overall occupation growth rates. Professional occupations now showed a strong tendency to respond positively to overall growth rates and as during 1941-51 only towns growing at above average rates had above average Professional occupation growth rates. Trade and Finance developed a moderate positive relationship with overall growth but its growth rate slipped from 65.68% in 1941-51 to one of the lowest (-2.21%). Only three towns experienced positive Trade occupation growth rates and they all had overall occupation growth rates more than 1.5 times the average for small towns. Apparently the 1941-51 boom had worn off and only small towns with exceptionally fast growing occupation structures continued to add to their Trade and Financial occupations.

1961-1971.- The analysis of variance revealed no significant differences among any of the nine occupation classes growth rates for 1961-71. All occupation groups had positive growth rates and all occupation classes but Other Primary showed a direct and strong to moderate attachment to overall occupation growth rates.

The high mean growth rate in Agricultural occupations is probably due to the effect of random rounding up or down by 5 in the 1971 census. For example, if a small town had two Agricultural occupations in 1961 and two in 1971 the rounding might indicate five occupations, creating a spurious 150% increase. Eliminating the extreme values from the sample yielded an average growth rate of about 25% for the 10 year period.

Growth was likely the result of local demand and farming conditions. The regression of Agricultural occupations per person (for all cities) indicated only a slight decline from 1961 to 1971. Relatively high levels of per capita agricultural occupations were maintained near the pole, ie. close to areas of rapidly growing population and demand (cf. the high population growth rates in Halifax-Dartmouth). If we were to regress only the per capita agricultural occupations of small cities the curve might show an increase from 1961 to 1971 considering the substantial growth rate in Agricultural occupations from 1961 to 1971, and the rapid population movement into the pole from the hinterland. The 1941-51 boom in Manufacturing occupations leveled off and only 6 towns of 13 had positive rates and these 6 tended to have above average overall occupation growth rates. Professional occupation growth rates continued to surge and only two towns (the only two with overall occupation growth rates that were negative) had a negative Professional growth.

1941-1971.- Most small towns showed strong and consistent gains in Professional and 'white collar' occupations vs. Manufacturing or Transportation type occupation growth. Growth in Professional occupations appeared not to be directly influenced by the pole but was strongly related to small cities whose overall growth rates were well above average. The overall growth rates may have been influenced by the pole but the specific nature of the impact is not clear.

CITY SIZE BETWEEN 2000 AND 5000

As in the previous section mean growth rates and the correlation values of class growth rates with Total occupation growth have been calculated and tabulated. Refer to tables 4-4 and 4-5.

TABLE 4-4

Mean Occupation Growth Rates (%) for Towns with Populations Greater than 2000 and Less than 5000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	-0.02	4.95	19.92
Agricultural	-43.04	-0.08	109.31
Other Primary	12.58	11.36	95.38
Manufacturing and Mechanical	60.72	84.30	-14.57
Transportation and Communication	16.37	-25.47	-3.23
Professional	9.17	45.75	37.42
Service and Recreational	-11.51	28.73	20.62
Trade and Finance	28.71	22.70	-9.93
Clerical	32.43	30.74	56.21
Number of Observations	11	14	13

TABLE 4-5

Simple Correlation of Total Occupation Growth Rates vs. Eight Sub-groups for Towns with Populations Greater than 2000 and Less than 5000

Occupation Sub-Groups	Total Occupation Growth Rates		
	1941-51	1951-61	1961-71
Agriculture	0.502	-0.512	0.005
Other Primary	0.227	0.528	0.524
Manufacturing and Mechanical	0.369	-0.166	0.313
Transportation and Communication	0.523	0.030	-0.190
Professional	0.119	0.481	0.364
Service and Recreational	0.320	0.299	0.674*
Trade and Finance	0.491	-0.374	0.788*
Clerical	0.095	0.466	0.672*

* = Significance $\geq$ 5% level

1941-51.- For 1941-51 the analysis of variance indicated that, at the 5% confidence level, no significant differences existed among the various occupation classes growth rates. The mean 10 year growth rates for Other Primary and Manufacturing and Mechanical Occupations were substantially inflated by extremely high growth rates of each (411% and 713% respectively) in Pictou. We are not aware of any reason for such a surge but strongly suspect that the occurrance is specific to Pictou and not

an indication of a general trend or a sign of the direct impact of the pole. Removal of Pictou from the group of eleven reduced the mean Other Primary occupation growth rate to -20% and the mean Manufacturing and Mechanical occupation growth rate to 17.85%. No single occupation growth rate was significantly related to the overall growth rate. On average, medium size towns appeared to maintain the status quo. Only three medium size towns of 11 observed had substantial Total occupation growth rates; Antigonish (40.45%), Bridgewater (10.57%) and Pictou (15.21%). There does not appear to be any dominant reason why these three should experience occupation growth so far in excess of the other eight observations.

1951-1961.- For 1951-61 the analysis of variance indicated that there were significant differences among the classes of growth rates. The NMRT indicated that mean Mechanical and Professional growth rates were two of the largest.

The period 1951-61 marked a moderate upturn in occupation growth in medium size towns. None of the mean rates were affected by extreme values in the sample observations. The regressions of Total, Manufacturing and Mechanical, Professional, Service and Recreation, Retail Trade and Finance and Clerical occupations per person (for all cities) seemed to support the occupation growth rates' indications of moderate growth. For example, Service and Recreation occupations per person had a minor turn around from the 1941-51 declining trend. In some cases despite positive occupation growth there was a dip in occupation per person levels near the pole. Most likely this is a response to the rapid

population growth rate near the pole for 1951-61. For example the Halifax-Dartmouth population growth rate was 38.61% while the provincial urban population growth rate was less than half that (15.85%).

1961-1971.- From the analysis of variance showed a significant difference among the occupation growth rate groups of medium size cities. The NMRT indicated that the six largest occupation growth rates were not significantly different from each other (see table 4-4).

Although the 1961-71 growth rates for Agricultural occupations appears impressive it is in fact not so. Random rounding in the 1971 census may have created several extreme values in the data set. As has already been mentioned, the NMRT indicated that the six largest growth rates were not significantly different, consequently the actual Agricultural growth rate could be estimated as low as 19.92%. The observation for Other Primary occupation growth may have been similarly inflated.

During 1961-71 growth in Clerical occupations showed a strong positive relationship to overall occupation growth as did Service and Recreation occupations. In both cases above average occupation growth rates tended to be associated with cities of above average overall occupation growth. Trade and Finance had a strong positive relationship also but positive growth rates were associated solely with cities whose overall occupation growth rates exceeded 22%. Where occupation growth was less than 22% all Trade and Finance occupation growth rates became negative. The regression of Retail Trade and Finance occupations per person (for all cities) indicated an increase in per capita occupations from 1961 to 1971 near the pole and a decrease from 1961 to 1971 beyond

120 miles. These two observations enable us to suggest that proximity to the pole influences the overall occupation growth of a city which in turn influences growth in the Retail and Financial sector. At this time we are not able to tell exactly why proximity to the pole would have such an impact. One possibility would be that accessibility to the pole is desirable and hence if growth is to take place it will take place where contact with the growth centre is easy and rapid. It is also reasonable to expect growth in Retail and Financial services near or at the greatest concentrations of population.

1941-1971.- In the main, mid-sized cities have improved their mean Total occupation growth rates since 1941. No pattern is evident in the growth of the eight occupation sub-classes. Rapid rises occur in the service and white collar sectors (which we do not expect to act as propulsive sectors). Much of the growth in medium size cities seems to rely on their being accessible to the pole. The indications are that migration is directed predominantly at areas which are accessible to the pole. A concentration of population should create a market that will help sustain growth initiatives and enable cites adjacent to the pole to follow the pole's growth impulses.

CITY SIZE GREATER THAN 5000

Mean occupation growth rates and the simple correlation values of the eight sub-groups vs. Total occupation growth were calculated. They are listed in tables 4-6 and 4-7.

TABLE 4-6

Mean Occupation Growth Rates (%) for Towns with Populations Greater than 5000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	6.09	-9.59	11.48
Agricultural	-29.09	-18.07	46.51
Other Primary	-8.34	-37.80	-10.43
Manufacturing and Mechanical	2.03	60.30	-3.30
Transportation and Communication	29.18	-30.59	1.14
Professional	24.87	34.74	39.19
Service and Recreational	-20.02	28.80	16.34
Trade and Finance	46.12	0.14	-5.61
Clerical	54.27	12.01	36.68
Number of Observations	11	11	11

TABLE 4-7

Simple Correlation of Total Occupation Growth Rates vs. Eight Sub-Groups for Towns with Population Greater than 5000

	Total Occupation Growth Rate		
Occupation Sub-Groups	1941-51	1951-61	1961-71
Agriculture	-0.287	0.328	-0.367
Other Primary	0.259	0.668*	0.160
Manufacturing and Mechanical	0.593	0.363	0.499
Transportation and Communication	-0.112	0.478	-0.294
Professional	-0.230	0.579	0.600
Service and Recreation	-0.187	0.126	0.374
Retail Trade and Finance	0.292	0.906*	0.124
Clerical	0.510	0.523	0.833*

*Significance $\geq$ 5% level

1941-1951.- In the decade 1941-51 no occupation class could be classified as a leading group by virtue of a moderate or strong relationship with the overall growth rate of occupations in large cities. The NMRT indicated that Clerical and Trade and Finance occupations had the largest growth rate. None of the 11 sample cities had a negative rate. Trade and Finance growth was closely followed by Transportation and Communication and Professional occupation growth. Manufacturing occupations grew slowly, outpacing only Agriculture (according to the NMRT). As with the small and medium size cities most growth appeared in the Professional, Trade and Finance and Clerical occupations.

1951-1961.- 1951-61 brought a large surge by Manufacturing and Mechanical and Professional occupations followed by a revived Service and Recreation class. Growth rates in Trade and Finance showed a strong positive relationship with overall growth. Only cities with positive overall occupation growth rates (9.59 percentage points above average for this decade) showed positive Trade and Finance occupation growth. Trade and Finance occupations showed a strong tendency to grow or decline as the overall occupation growth rate grew or declined. It appears that Trade and Financial occupations in large cities may have been directly tied to the overall prosperity of the city. Other Primary occupations also showed a positive and strong relationship with Total occupation growth rates. No large city had a positive growth rate in Other Primary occupations but there was a strong tendency for the rate to be less negative as overall occupation growth rates increased.

1961-1971.- The analysis of variance indicated no significant difference among the classes of occupation growth rates. Growth in Clerical occupations showed a strong positive relationship to overall growth. Cities with Total occupation growth rates exceeding 8% tended to have above average Clerical occupation growth rates. A decline in Clerical occupations was observed in only one city. The Agricultural occupation growth rate was substantially inflated by an extremely high value at New Waterford which could be due to random rounding in the 1971 census or to a local phenomenon. Elimination of this extreme case reduced the mean Agricultural occupation growth rate to about 8%. Extremely high rates of growth in Other Primary occupations were recorded for Yarmouth and Truro. Their elimation reduced the mean to -39%. These two situations are most likely local phenomena and not linked to activity in the pole.

1941-1971.- The 1961-71 decade marked a turn around in the occupation growth of large cities. From 1951-61 to 1961-71 the Total occupation growth rate increased by 21 percentage points. This would tend to suggest that 1961-71 was a period of vigorous growth in large cities. Similarly, 1941-61 was a period of significant decline, the Total occupation growth rate dropping almost 16 percentage points. While one would expect more consistency in the growth patterns of large cities they appear to have more erratic growth paths than small or medium size cities in Nova Scotia (compare total occupation growth rates from tables 4-2, 4-4 and 4-6). The data and analysis so far does not offer an explanation.

CONCLUSIONS RE: HALIFAX-DARTMOUTH AND THE POLE REGION

We did not find an occupation class with consistently high growth rates that were strongly associated with overall occupation growth rates. Only in the few instances cited did growth rates of particular classes of occupations show strong positive relationships to overall occupation growth rates. In most cases the various occupation class growth rates were randomly associated with overall occupation growth rates. This would seem to indicate that most growth is not related to overall growth rates in the region but possibly to some over lying national trend or a response to specific local conditions viz a vis the pole. This also suggests that high occupation growth rates may not be the key to identifying cities that actively respond to growth impulses from the pole or participate in the regional economy. No one occupation class dominated the occupation growth structure. The pole functioned as an administrative, professional and government service centre and probably generated multipliers whose effect remained predominantly internal to itself.

The regression of Total occupations per person (figure 4-1) indicated that despite the 30 year growth trend in pole welfare, levels in the pole region have been declining. This runs counter to what pole theory leads us to expect. Halifax-Dartmouth apparently did not transmit growth impulses to the hinterland but grew at the expense of the hinterland. Our analysis indicates that the central concept of pole theory, polarization, has turned into a backwash effect. The problem for policy makers and regional planners is how the backwash effect can be overcome.

Growth in Manufacturing and Mechanical occupations did not occur in the pole to any large extent. We suspect that the hinterland growth in this area was a response to demands made by the rapidly populating pole and to a national upturn in the Manufacturing and Mechanical sector.

Throughout the 30 years from 1941 the pole operated as an administrative, government, and service centre as is evident by consistently high Professional and Clerical occupation per person levels.

We expected per capita Retail Trade and Finance occupation levels (which includes managerial occupations) to be higher at the pole than was observed. The regression indicated a peak about 30 to 60 miles out from the pole. Beyond 150 miles occupation per person levels declined over time. We suspect that the Retail, Financial and Managerial structure of the pole was sufficient to absorb a shift of higher order service demands from hinterland centres to the pole. Such an explanation is conjecture, a complete accounting needs more research into the topic.

Of the growing per capita occupation classes only Manufacturing and Mechanical and possibly Services and Recreation occupations per person did not appear to be affected by the backwash effect. Stimulation of the manufacturing and tourism sectors of the economy may provide a means to break the hold of the extremely powerful levels of polarization about the pole (cf. fn. 1, Chapter Four). The pole does not appear to act as a development centre but it no doubt acts as a solid base for the regional economy, a base which has helped sustain the traditional economic structure. As well the growth internal to the pole which was induced by the increase in government, professional and administrative services probably provided a much needed escape valve for population pressure in

the hinterland (cf. the pole's increasing share of the urban population). It is possible that the pole's internal growth provided a useful function. That is; it attracted the surplus population from a hinterland of historically low potential. Klaasen (1972a) and Hansen (1968) would agree that the prospect of Halifax-Dartmouth attracting and supporting surplus population from a hinterland of low potential is reason enough to designate Halifax-Dartmouth as a growth pole (even if it cannot achieve development pole status). Much of the growth around and in the pole may be due to a polarization around Halifax-Dartmouth. But when no further large immigrant flows from the hinterland are possible (at which point growth in the pole may be frozen), the whole region may slip into an extended period of stagnation. Therefore the goal of development pole status for Halifax-Dartmouth should not be given up too easily.

Hermansen (1972a) would remind us that where backwash and cumulative causation exist development makes for more efficient spread effects than simple growth. If the persistent lack of complementarities in the Nova Scotian economy continues to exist the backwash effect will be exacerbated, ie. the pole will continue to grow at the expense of its hinterland and begin to interact only with the national urban hierarchy and ignore its own hinterland. The trend may become so powerful that it will be even more difficult to turn it around. Erikson (1975) found that in Seattle where Boeing's spatial linkages were aligned across the urban hierarchy and local growth came about in the household service sector as a response to increases in household demands due to expansions in Boeing and therefore in its wage payments. We suspect that such could be the case

with the Halifax-Dartmouth urban complex and even more so in Sydney where the steel plant's spatial economic linkages may be alligned predominantly beyond provincial boundaries.

Our analysis suggests that Halifax-Dartmouth may not be acting as a development pole or as a growth pole, it is not transmitting growth impulses to the hinterland as the theory suggests a growing pole should. The polarization of the region around Halifax-Dartmouth has turned into a backwash effect. More attention needs to be paid to measures which will internalize the spatial impact of growth. For example, consideration should be given to developing the manufacturing sector of the economy (a sector which shows promise, cf. figure 4-4). There is potentially a greater chance that these types of occupations can be spread out away from the pole (via economic incentives, small branch plants and suppliers and so on) than can government and administrative related occupations. If the pole continues to grow at its rapid rate and the backwash effect is not attenuated its hinterland may become an economic vacuum. While the pole could probably sustain itself by concentrating on its linkages with the upper levels of the Canadian urban hierarchy its hinterland cannot sustain itself without direct socio-economic contact and input from the pole.

CHAPTER FIVE - THE QUEBEC CITY POLE REGION

Quebec City was to be developed as a growth pole that would transfer the growth impulses from Montreal down the urban hierarchy of Quebec City. Rather than act as a development centre and compete with Montreal its purpose would be to reinforce the Quebec City pole region and in turn strengthen the Montreal urban hierarchy of which it is a part (Higgins, 1970). We propose to describe economic activity in the Quebec City region for i) phenomena expected of a growth pole, ii) the influence of Montreal and iii) the feasibility of Quebec City's acting as a growth pole considering its past growth experience and the long run impact of Montreal.

Quebec City is the capital of the Province of Quebec but not its largest city (1971 population = 186,088). Half a dozen cities in the Quebec City hierarchy have fast growing populations wich are already of moderate size (15,000 to 35,000), a constrast to the situation in Nova Scotia.

We have limited our study area to a 160 mile diameter circle around Quebec City because we did not expect Quebec City to directly influence the growth of the whole province. We felt that a study area half way to Montreal would be sufficient to allow interpretation of Montreal's influence while still focusing the analysis on Quebec City's hinterland.

DATA SOURCES

The same data sources were used as in the Halifax-Dartmouth study.

CHOICE OF THE DEPENDENT VARIABLE

The same experiments were conducted with virtually identical results. Occupations per person was chosen as the dependent variable.

Quebec City was deleted from the data to reduce any spurious relationships. The problem was not as serious as in the Halifax case since the observations were more evenly spread throughout the 80 mile radius versus the 30 mile gap in the case of the immediate area of Halifax.[1]

RESULTS OF THE ANALYSIS

The following two sections report the results of the regression analysis, analysis of variance and correlation analysis. The regression was judged significant using the criteria employed in Chapter Four. The statistical results of the nine regression analyses are listed in table 5-1.

OUTPUT OF THE REGRESSION MODEL

The next nine sections summarize the regression analysis as

---

[1] The deletion of Quebec City raised the R^2 from 0.074 to 0.1007 and reduced the standard error slightly.

TABLE 5-1

Regression Output for the Quebec City Region

Dependent Var.				Regression Coefficient*								
Per Capita Occupations	R^2	Std. Error**	Reg'n Signif.	Constant	t	s	st	st^2	s^2	s^2t	dummy
Total Occupations	0.1007	14%	0.00040	-0.88040	-0.02156	-0.00540	-	0.00007	0.00004	-	-0.00066
Agricultural	0.2091	174%	>0.00001	-4.50603	-0.73619	-	0.00607	0.00172	-	-0.00011	0.00482
Other Primary	0.2200	145	>0.00001	-7.26571	-0.17162	0.09326	-	-	-0.00833	-	-
Manufacturing & Mechanical	0.1203	55	>0.00001	-2.03844	-	-	-	-	-	-	-0.00354
Transportation and Communication	0.0304	55	0.03060	-3.84012	-	0.00943	-	-	-0.00013	-	-
Professional	0.1258	62	0.00006	-3.55901	0.11369	-0.00853	-0.00685	0.00139	0.00016	-	-
Service & Recreation	0.2228	44	>0.00001	-3.54622	-	0.00874	-0.01663	0.00315	0.00011	-	0.00182
Retail Trade & Finance	0.1863	35	>0.00001	-3.28972	0.15110	-0.00818	0.00644	-0.00203	-	0.00002	-0.00087
Clerical	0.4507	57	>0.00001	-3.58166	0.27699	-0.02961	-0.00476	0.00103	0.00031	-	-0.00128

*The coefficients have not been standardized.

**As a Percentage $\pm$ the predicted value of the dependent variable.

applied to total occupations per person and the eight sub-groups.

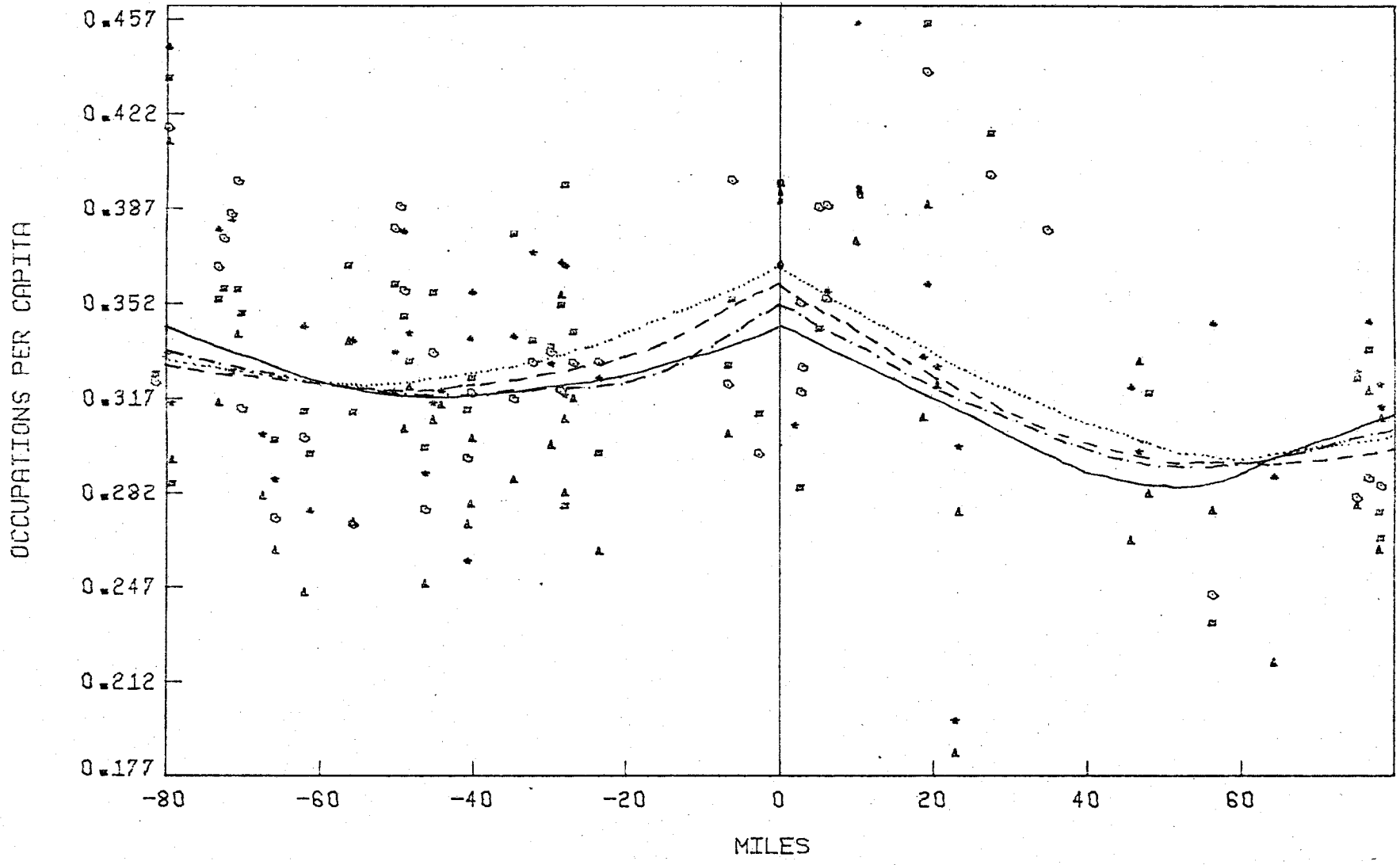
Dependent Variable: Total Occupations Per Person.- Relative to the Halifax output the results for Quebec were not quite as convincing regarding the existence or non-existence of spatial-temporal trends (figure 5-1). There did appear to be a downward movement over time within 50 miles (especially as 1971 approached). The 30 year decline in the pole area could be explained by an absolute population growth in excess of absolute occupation growth. In the report of the analysis of variance results we will see that for all sizes of cities mean total occupation growth rates have always been positive, consequently population growth may have had a major impact on welfare levels. It appears that occupation growth within 50 miles of Quebec City has not kept pace with population growth. The 30 year decline in occupation per person levels in the zone facing Montreal was not as dramatic as the zone to the Northeast of Quebec City.[2]

The growing cities of Trois Rivieres, Cap-de-la-Madeleine, Victoriaville and Shawinigan probably were the cause of the reduced decline and then large upturn on the Quebec City-Montreal axis. This

---

[2] Originally the variable d was to be a dummy variable; "1" if the observation was on the Montreal side of Quebec City and "0" if it was not. Initial runs of the model suggested that a continuous distance function would be more appropriate. Ideally straight line distance to Montreal should be used but time restrictions forced a compromise: the distance from Quebec City to Montreal was added to all cities which were assigned a "0" dummy variable and the distance from Quebec City to a city with dummy value "1" was subtracted from the Montreal to Quebec City distance. This procedure gave an approximation of each city's distance to Montreal. Granted, the measurement would be exactly correct for only those cities which lie directly on the axis running through Montreal and Quebec City.

FIGURE 5-1: Total Occupations; The Quebec City Region



⊙ = 1941 observation
□ = 1951 "
△ = 1961 "
* = 1971 "

..... = 1941 regression line
– – – – = 1951 " "
–·–·– = 1961 " "
——— = 1971 " "

Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

first regression does not present proof that Quebec City has acted as a growth pole. It has apparently not transmitted growth to its Northeast. Instead growth seems to have been bottled up in the Montreal-Quebec City corridor.[3]

The first regression made evident a misconception we had had about the Quebec City region. The pole may not be Quebec City itself but the complex of cities within 10 or 15 miles of the old city. We aggregated the cities in our data set that were part of the Quebec City Metropolitan Area (some small suburbs had to be left out as they were not available in our data collection) in order to have an estimate of growth in the Metropolitan area.[4] The per capita occupation values are listed in table 5-2. In only one case, Manufacturing and Mechanical occupations per person (1971), was the Metropolitan Area's welfare level below the trend indicated by the regression. But all 1971 levels were below their 1941 levels. Total occupations per capita showed a continuous decline throughout the 30 year period.

Although there has been positive growth in the absolute number of occupations the growth has not been able to keep up with population growth. From 1941 to 1951 the Metropolitan Area's population grew by 34.9%, from 1951 to 1961 43.3% and from 1961 to 1971 103.5%. In 1941, 1951 and 1961 the Metropolitan Area's share of the regional population was 23.8%,

---

[3] As in the case of Halifax-Dartmouth the values of the dependent variable for Quebec City have been marked on figures 5-1 through 5-9 but they were not included in the regressions.

[4] The cities aggregated were: Quebec City, St. Foy, Loretteville, Charlesbourg, Giffard, Beauport, Montmorency, Courville, Lauzon, Levis and Charny.

TABLE 5-2

Estimate of Quebec City M. A. Per Capita Occupation Levels

Occupation Class	1941	1951	1961	1971
Total Occupation	0.742	0.678	0.571	0.367
Agricultural	0.009	0.006	0.003	0.002
Other Primary	0.002	0.001	0.001	0.001
Manufacturing and Mechanical	0.163	0.123	0.129	0.043
Transportation and Communication	0.062	0.059	0.039	0.009
Professional	0.074	0.068	0.078	0.063
Service and Recreational	0.127	0.088	0.088	0.050
Retail Trade and Finance	0.091	0.114	0.091	0.063
Clerical	0.087	0.101	0.101	0.078

26.9% and 28.3% respectively. By 1971 it shot up to 48.4%.

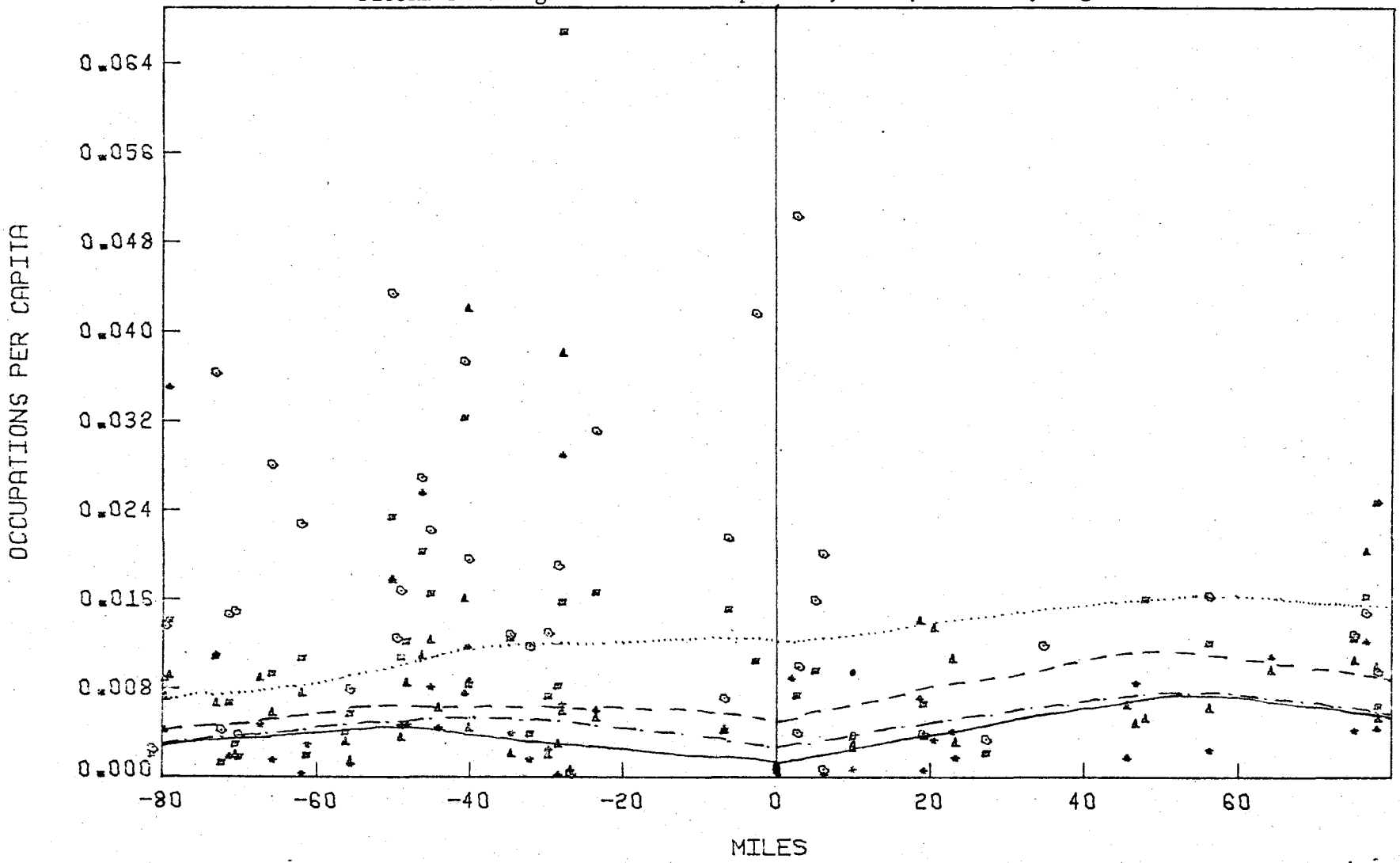
Apparently there has been a polarization of population growth on the Quebec City Metropolitan Area. The polarization may have drawn off some of the surplus population of the hinterland (especially in the Northeast sector) and helped maintain the status quo or even create a minor turn around in welfare levels. As in the case of Halifax-Dartmouth the extreme levels of polarization cannot be allowed to continue indefinitely. The Quebec urban hierarchy is stronger and better developed than the Nova Scotian urban system. Ultimately the result will be a denuding of the the hinterland in favour of the pole. The pole may lose all contact with its hinterland and interact only with the upper

levels of the Canadian urban system. In no way would this situation support or strengthen the urban system dominated by Montreal or Montreal's position in the overall system of Canadian cities.

Dependent Variable: Agricultural Occupations Per Person.- With due recognition for the weakness of the regression output we can make some cautious observations about per capita Agricultural occupation levels (figure 5-2). Due to a higher level of urbanization within 50 miles of Quebec City higher levels of per capita Agricultural occupations were not concentrated around the pole as in the case of Halifax. There was a decline over time. Two peaks were observed, each about 40 miles out from the pole. The Northeast sector showed itself to have a stronger (but declining) per capita Agricultural base. The rate of decline diminished towards 1971 and appeared to be approaching a base level as the Halifax region did by 1961-71. We could discern no phenomena involving per capita Agricultural occupations that might be directly related to activity in the pole. The two peaks at 40 miles may indicate an agricultural ring and urbanized core relationship. More dense urbanization along the Montreal-Quebec City axis tended to suppress occupation levels.

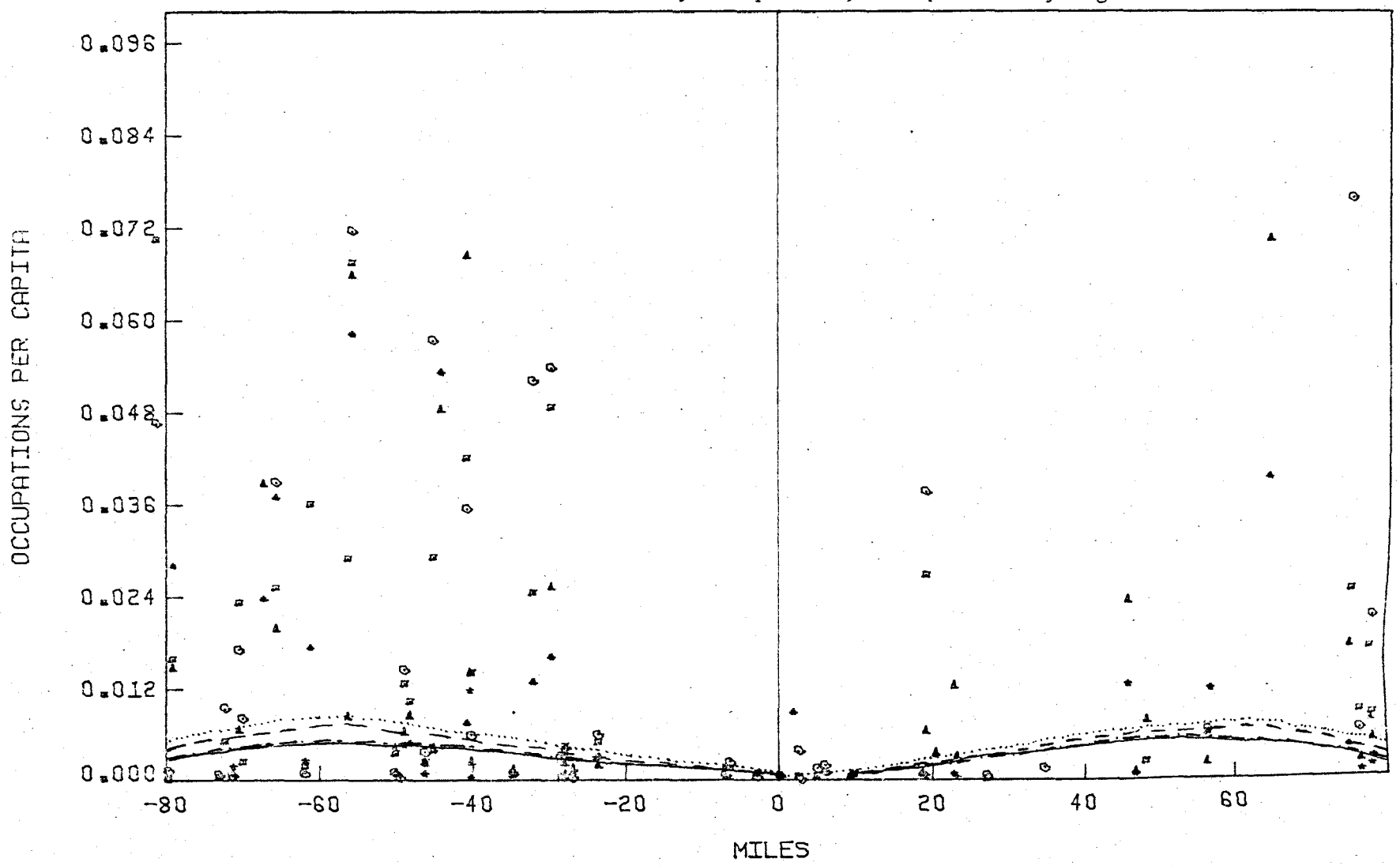
Dependent Variable: Other Primary Occupations Per Person.- Relative to the Halifax regression the statistical output of this run was an improvement. No indications of growth pole activity in the pole were uncovered. The very low importance in the pole and the lack of Montreal's impact suggests that changes in Other Primary occupations per person (figure 5-3) in this region were related to favourable or unfavourable in situ

FIGURE 5-2: Agricultural Occupations; The Quebec City Region



Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

FIGURE 5-3: Other Primary Occupations; The Quebec City Region



Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

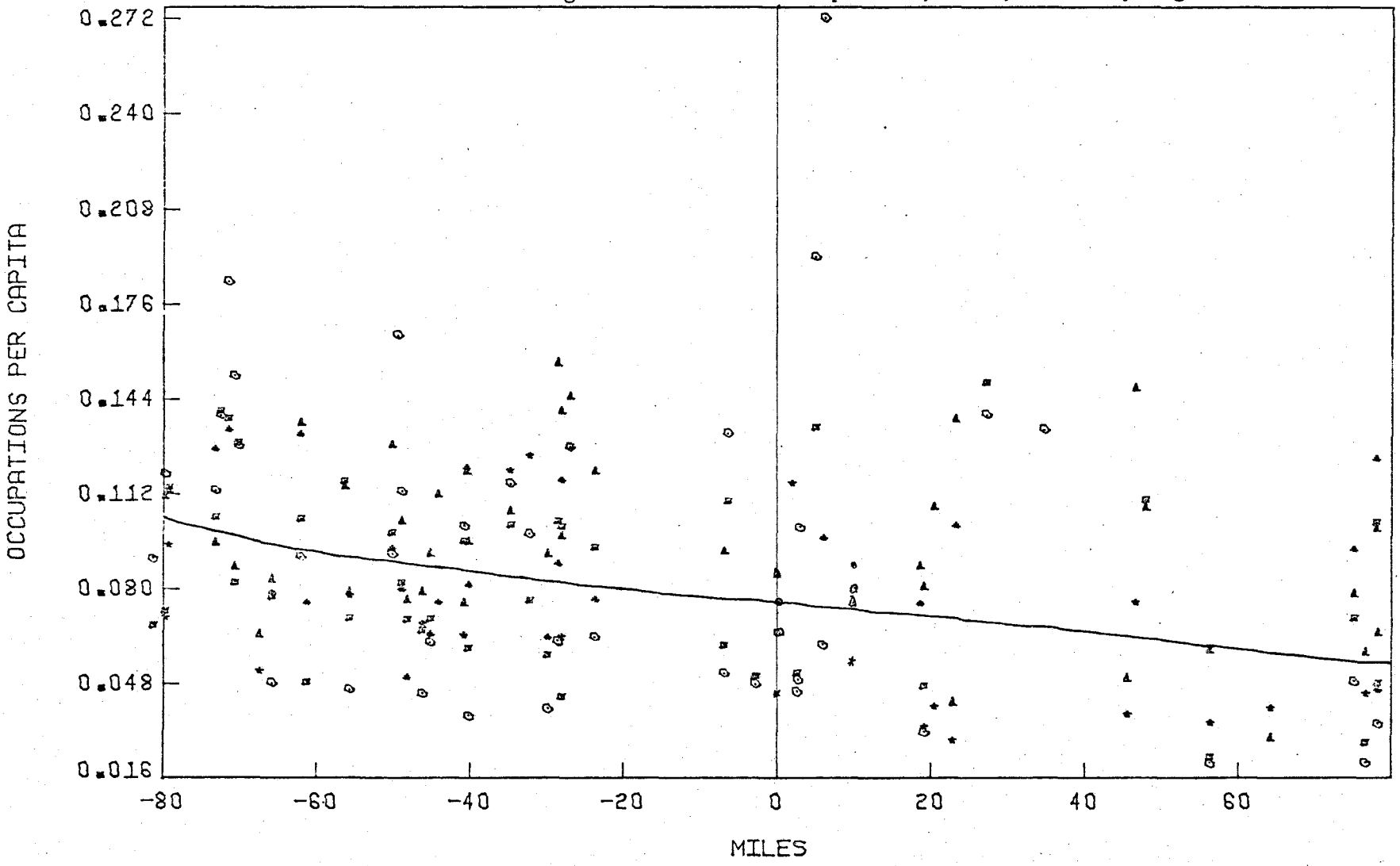
conditions for Primary and related occupations and to changes in demand for primary products from within and outside the region.

Dependent Variable: Manufacturing and Mechanical Occupation Per Person.- Even considering the weak results of the regression the pattern exhibited by per capita Manufacturing and Mechanical occupations is interesting (figure 5-4). The regression suggests that the pole may not influence Manufacturing and Mechanical occupations in a spatial or temporal sense, the sole influence appears to be Montreal and probably the growth of the cities between Montreal and Quebec City. In the pole city itself per capita Manufacturing occupations showed no definite growth trend. The pole city does not appear to have had an impact in the Manufacturing sector of the region. The supply and development of manufactured products must rest with Montreal.

Dependent Variable: Transportation and Communications Per Person.- The statistical results were so poor that little comment is warranted except to say that there may have been a tendency for more Transportation and Communication jobs (figure 5-5) to occur in the ex-urbs of the pole where more rapid urban growth and urban spread may occur.

Dependent Variable: Professional Occupations Per Person.- Cautious interpretation of the regression output (given the relatively low R^2, etc.) allows some insight into the change in the region's per capita Professional occupation levels (figure 5-6). Montreal's influence was marginal and hence not included by the stepwise regression. Growth in per capita Professional occupations appeared to be focused on the pole until 1961.

FIGURE 5-4: Manufacturing and Mechanical Occupations; The Quebec City Region

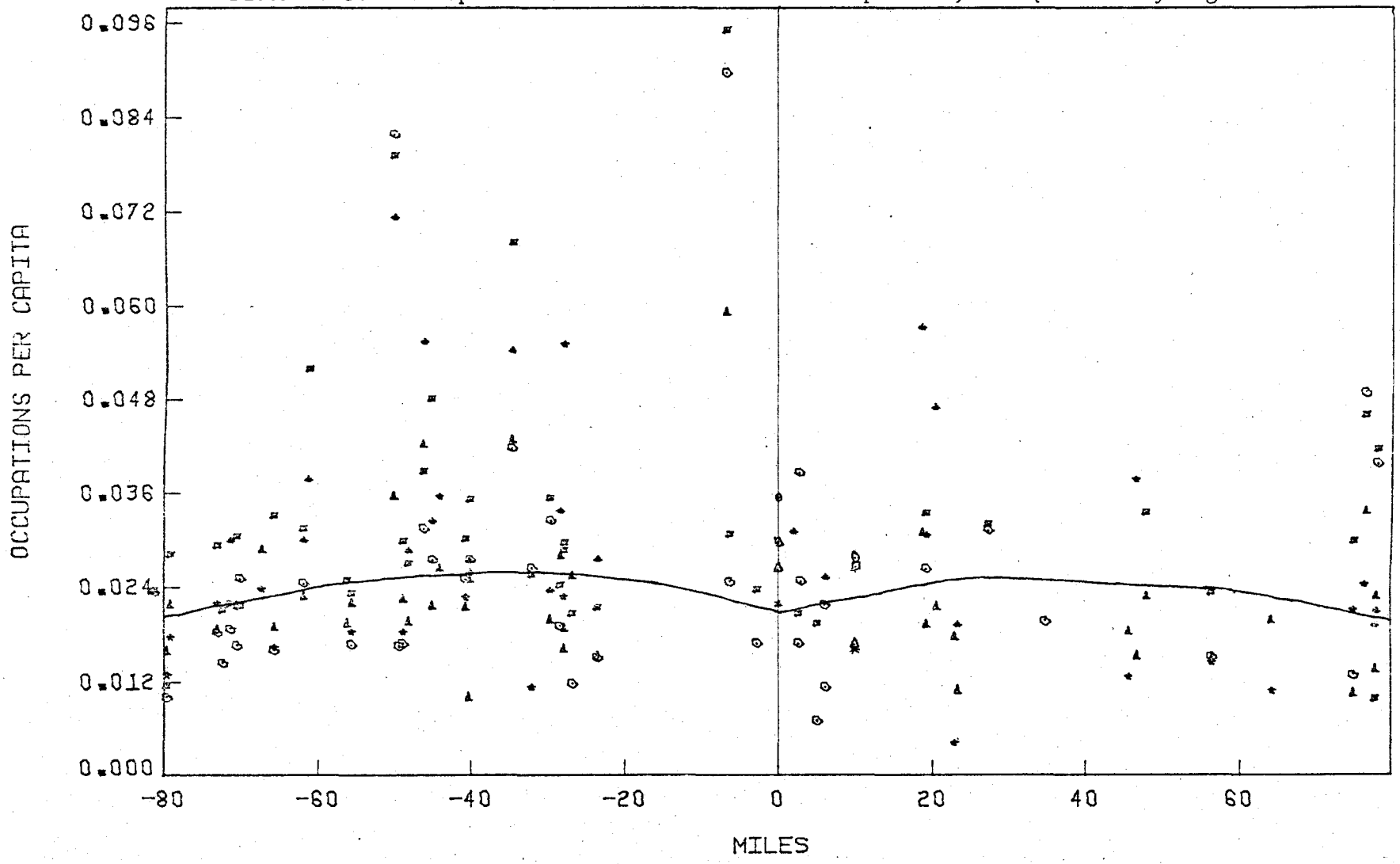


o = 1941 observation
□ = 1951 "
∅ = 1961 "
+ = 1971 "

..... = 1941 regression line
– – – = 1951 " "
-·-·- = 1961 " "
——— = 1971 " "

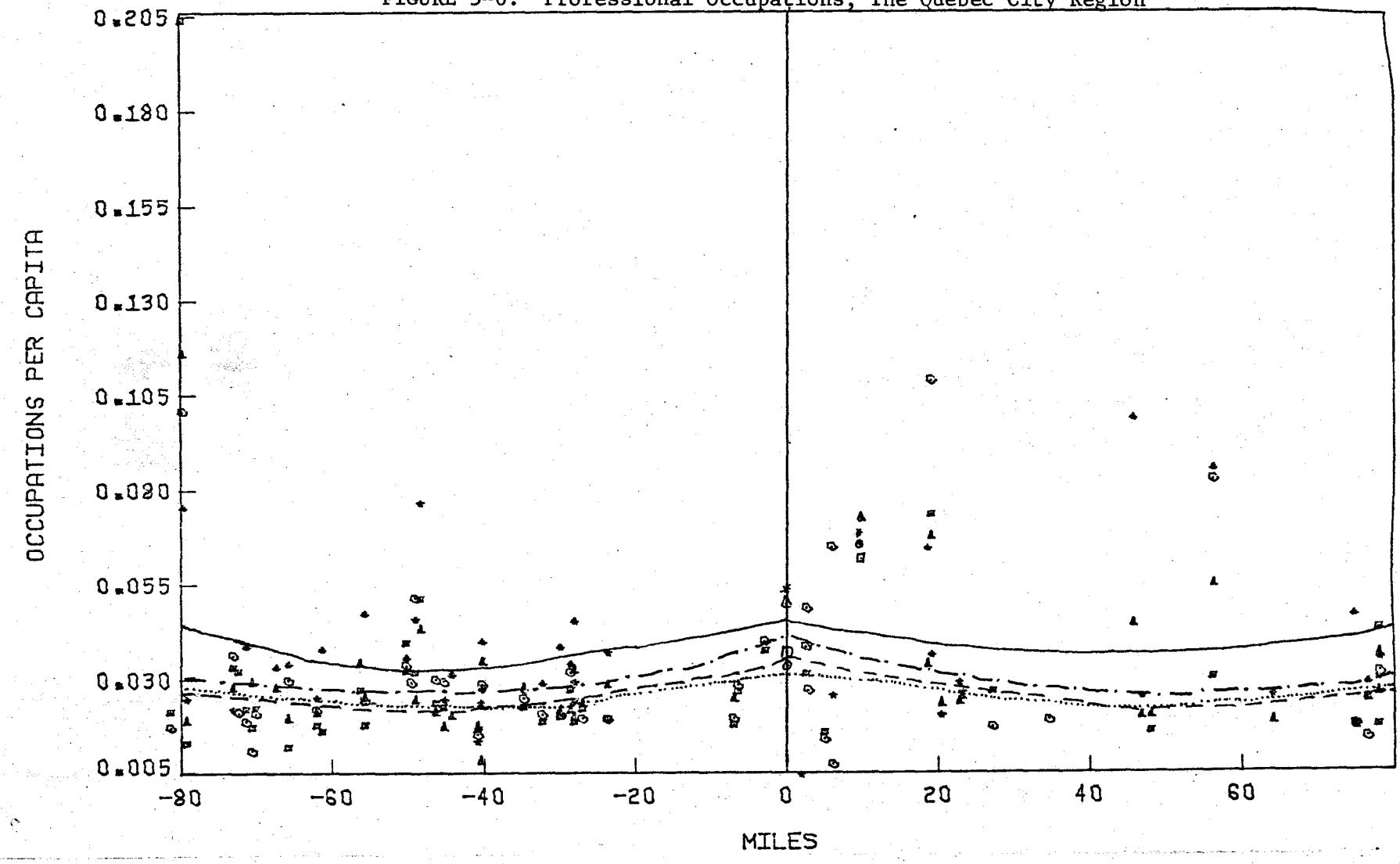
Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

FIGURE 5-5: Transportation and Communication Occupations; The Quebec City Region



Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

FIGURE 5-6: Professional Occupations; The Quebec City Region



⊙ = 1941 observation
▱ = 1951 "
◪ = 1961 "
* = 1971 "

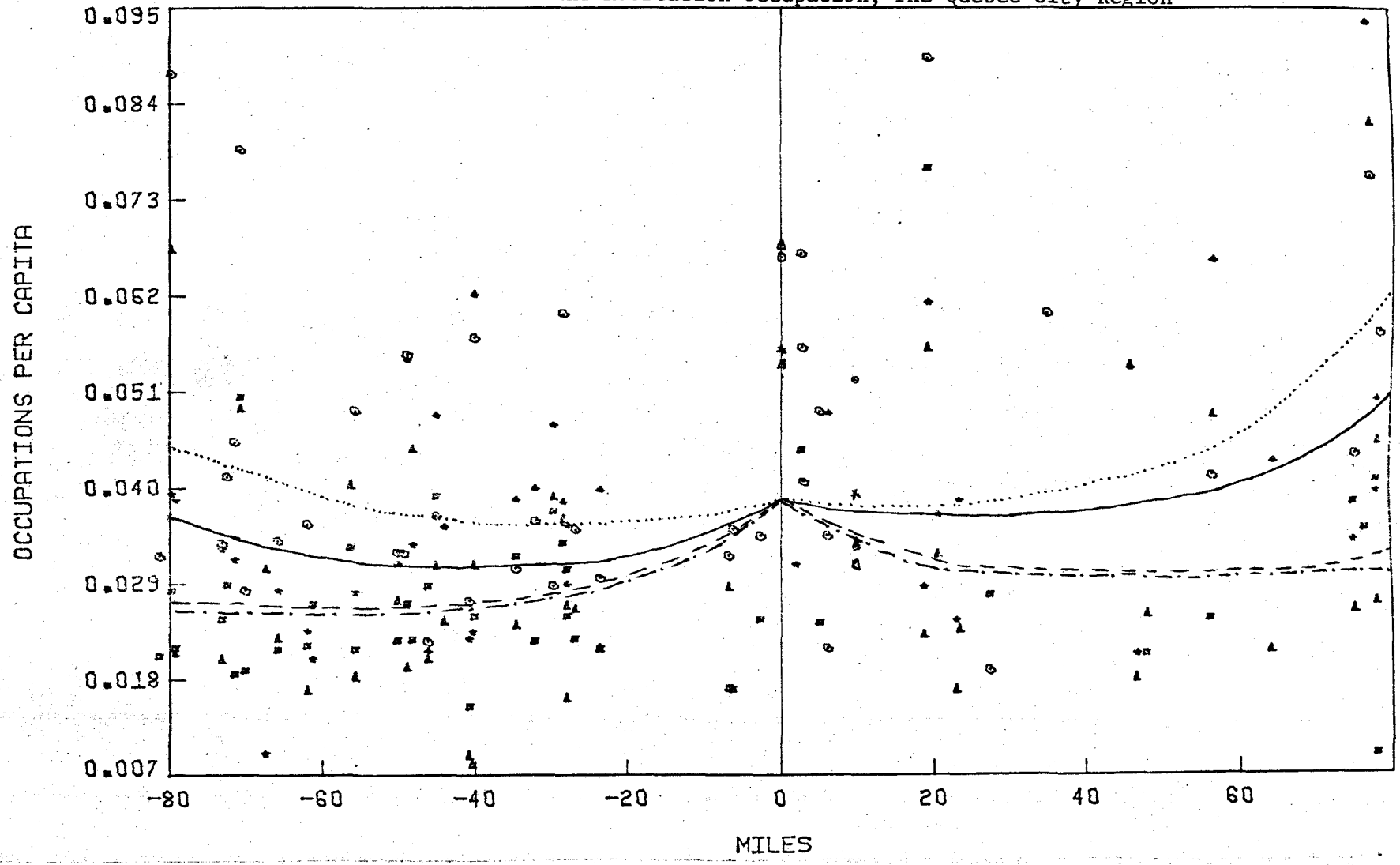
..... = 1941 regression line
– – – – = 1951 " "
–·–·–·– = 1961 " "
——— = 1971 " "

Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

From 1941 to 1951 increases in the level of the dependent variable were experienced near the pole and decreases occurred beyond 40 miles. By 1961 levels at all distances were higher than in the 1941-51 decade. Values of the dependent variable in 1971 near the pole were barely distinguishable from the two peaks at 80 and -80 miles. The 30 year growth in per person levels near the pole was 42% versus 50% at the extremes of the pole's region. 1961-71 apparently signalled a trend to improved professional services in the region's urban hierarchy. Pre-1961 growth adjacent to the pole was probably due to government growth. Rapid post-1961 growth in the hinterland (30 miles and beyond) may have been a sign of an improvement of welfare levels in the region made manifest by its ability to support an expanded Professional service sector. The pole may have had a positive impact in this instance. We suspect that the growth in government functions at the pole helped insure a long term economic base for the whole region. The prospect of a solid base may have assured the viability of increased per capita Professional services. These notions must be accepted with caution as only general trends have been described by the regression model.

Dependent Variable: Service and Recreation Occupations Per Person.- We had expected Service and Recreation occupations per person (figure 5-7) over time in what we considered to be a service and tourism centre. Apparently the levels declined until 1961 and rose again until 1971. The result was an overall 21% decline to the extreme Northeast of the pole city and a 27% decline facing Montreal. Levels in the area immediately adjacent to Quebec City did not change with time. Per capita levels

FIGURE 5-7: Service and Recreation Occupation; The Quebec City Region



ø = 1941 observation
□ = 1951 "
◁ = 1961 "
* = 1971 "

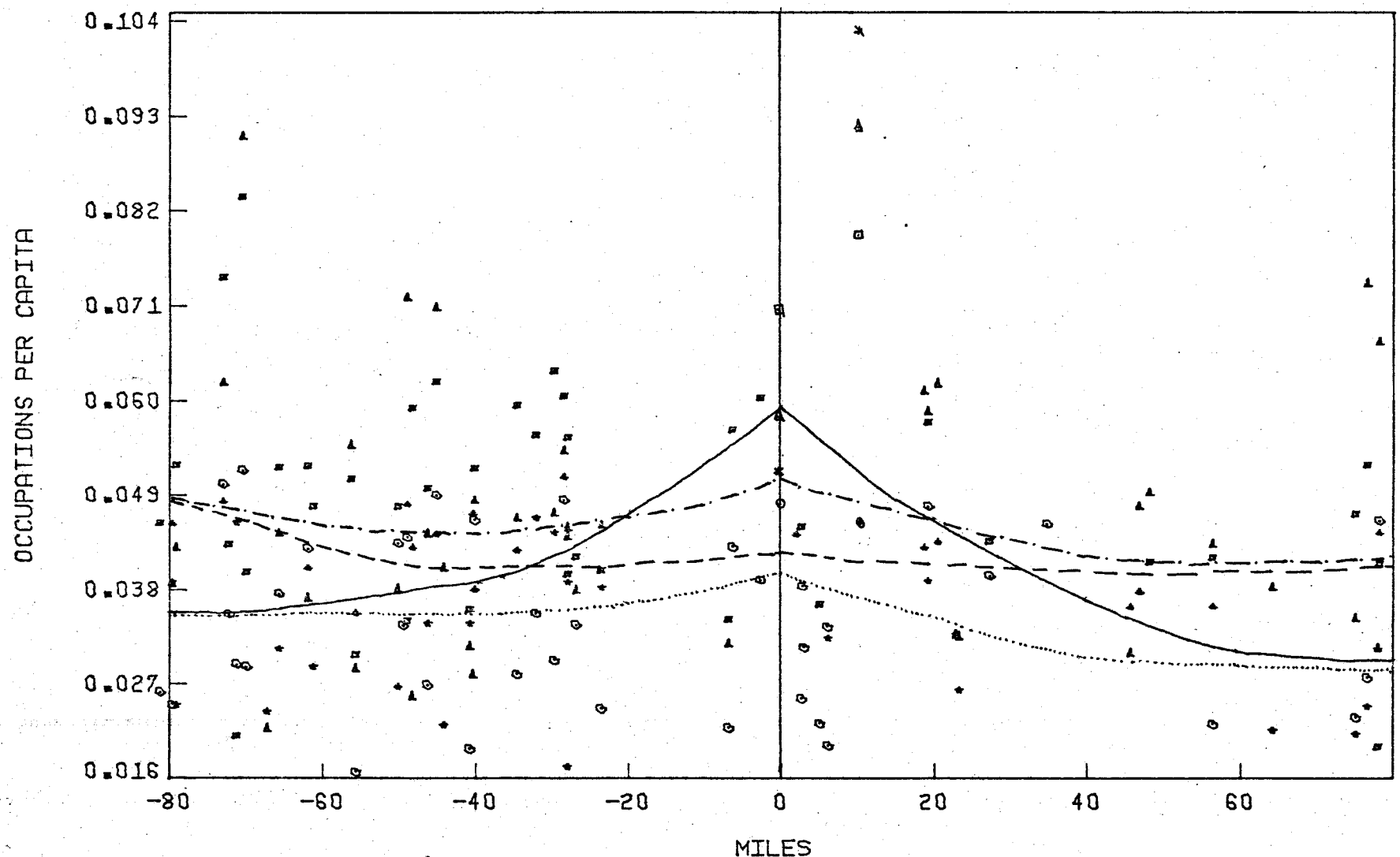
..... = 1941 regression line
– – – – = 1951 " "
—·—·— = 1961 " "
——— = 1971 " "

Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

remained relatively high in the pole throughout the 30 year period. At this time we are not able to explain the 1941-61 decline in per capita Recreation and Service occupations. We offer that the growth from 1961 may be due to a renewed emphasis placed on attracting tourists to the region and a lagged response to the rapid regional population growth rates from 1941 to 1961 (1941-51, 29.43%; 1951-61, 36.17% and 1961-71, 19.12%). Throughout this time period Quebec City's 10 year population growth rate hovered between 8.79% in 1941-51 and 8.20% in 1961-71. The decline in per capita Service and Recreation occupations from 1941 to 1961 could have been due to population growth in excess of occupation growth. Ameliorated population growth from 1961 to 1971 and brisk Service and Recreation occupation growth rates from 1961 to 1971 (see tables 5-2, 5-4, 5-6) evidently resulted in the upturn. We cannot suggest if the pole had any impact on the situation other than being a focal point for the region's tourist and service trade.

Dependent Variable: Retail Trade and Finance Occupation Per Person.- Given due consideration for the quality of the statistical results we determined that per capita Retail Trade and Finance occupations (figure 5-8) had a variable relatioship to time and distance. The tendency from 1941 to 1961 appeared to be a general increase (approx. 39%) with only a slightly larger increase in the Montreal-Quebec City corridor. 1961-1971 brought a dramatic polarization of occupations per person around Quebec City. Even the Montreal axis switched focus to Quebec City. The pole (and the immediately adjacent cities) had 30 year growth levels of about 63% versus a 37% decline for the extremes of the hinterland. There is

FIGURE 5-8: Retail Trade and Finance Occupations; The Quebec City Region



⊙ = 1941 observation
⊡ = 1951 "
△ = 1961 "
✱ = 1971 "

..... = 1941 regression line
– – – – = 1951 " "
–·–·–· = 1961 " "
——— = 1971 " "

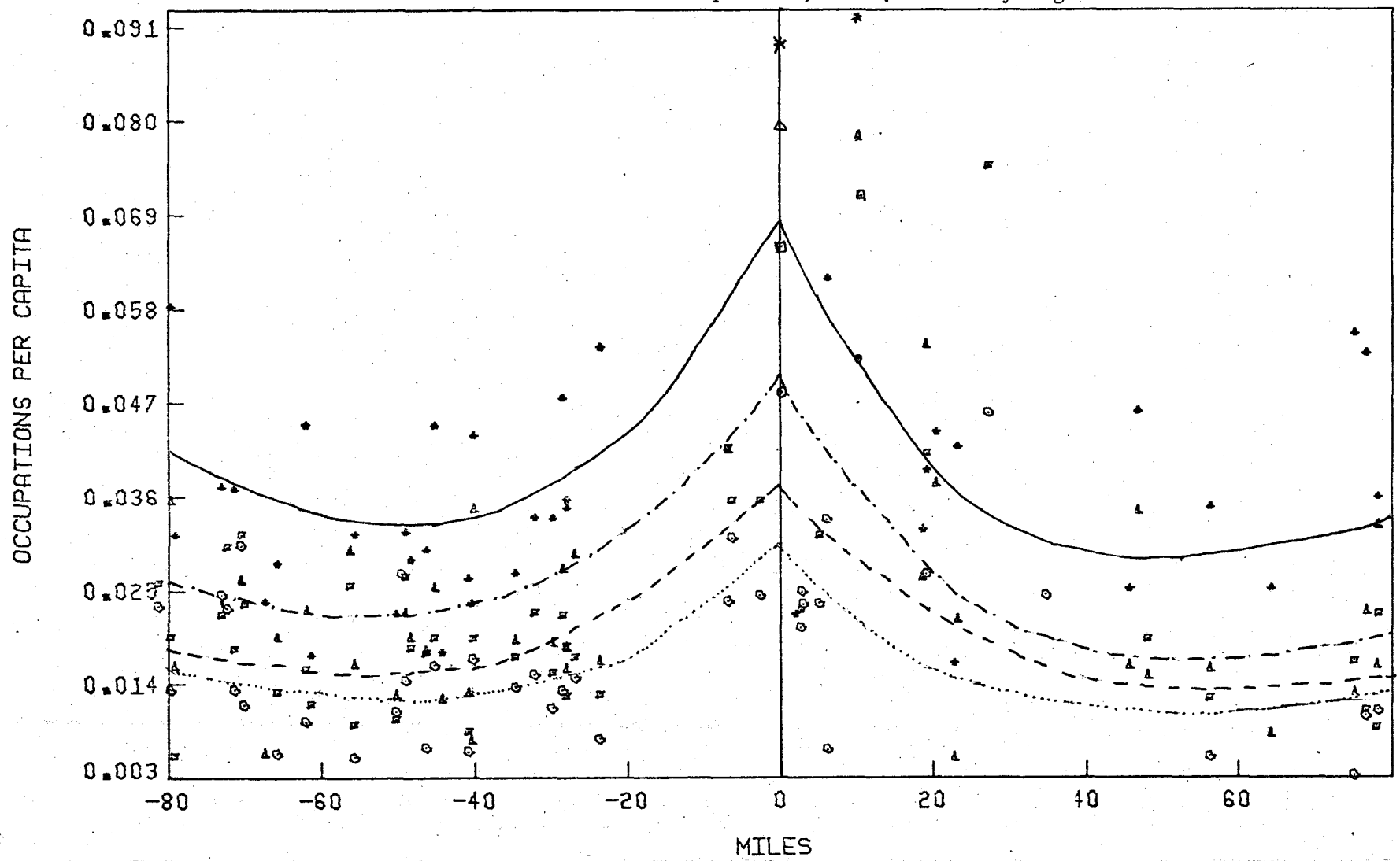
Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

nothing in the regressions that offer clues to the reasons for the turnabout from 1961 to 1971. The obvious implication of such a trend is a polarizing of the financial, managerial and retail infrastructure on the pole. The literature on pole theory suggests that this is not an optimal state of affairs. Quebec City may have began to expand its financial and retail sector at the expense of its hinterland. Quebec City may be interacting with other intermediate size cities and capitals across the national urban hierarchy and by-passing its own hierarchy of cities (cf., Nichols, 1969). The population around Quebec City may now have to commute to Quebec City for higher order Retail Trade and Financial services.

Dependent Variable: Clerical Occupations Per Person.- The regression of per capita Clerical occupations (figure 5-9) had the largest R^2 of any regression in either the Quebec City or Halifax-Dartmouth case. In 30 years Clerical occupations per person grew 130% in areas immediately adjacent to Quebec City. Growth in the areas closest to Montreal was approximately 154% versus 148% in the most distant areas Northeast of Quebec City. At each time period the per capita occupation level in the pole city was higher than the general trend although the pole experienced only an 88% increase over 30 years. This would indicate a tendency for growth in Clerical occupations per person to spread to the poles hinterland. The 10 year rate of growth in per capita Clerical occupations increased each time period.

This description of the spatial and temporal distribution of per capita Clerical occupations reflects the very strong impact of government

FIGURE 5-9: Clerical Occupations; The Quebec City Region



Note: Negative milage units indicate cities between Montreal and Quebec City. Quebec City is at 0 miles.

on the Quebec pole region. We assume that many of the Clerical jobs are related to expansions in the provincial government. Growth in Professional and Trade and Financial occupations is also connected with growth in government. Each of these two occupations has attached to it a need for Clerical employees. Therefore the growth of government and the related Professional and Retail and Financial and managerial expansion have all contributed to the expansion of per capita Clerical occupations.

SOME INFERENCES DRAWN FROM THE REGRESSION OUTPUT

Employment opportunities created by increases in the scale of the provincial government's operations are apparently the key to growth in the pole region. There has not been demonstrated to be too much hope for growth in sectors besides the service and administrative elements of the economy. This situation probably was sufficient with respect to Quebec City's position viz a vis Montreal. Montreal could maintain dominance in Retail, Financial, Manufacturing and Mechanical and related sectors and Quebec City offered a stable market with moderate growth based on government.[5]

Intuition suggests that the government cannot continue to grow indefinitely. Some recognition needs to be taken of this fact and preparations made for the stimulation of other sectors because the decay and stagnation of the Quebec City region would be as much a problem for Montreal as misdirected competition from Quebec City.

---

[5] One does not expect the Government to move out or go bankrupt therefore the city gains added stability that makes investment in the area more secure and at the same time helps insure some degree of stability in the provincial urban hierachy centred on Montreal.

We have found that the backwash effect may occur or already exists in the Quebec City region. Population growth and probably occupation growth, has polarized on the Quebec City Metropolitan Area. The seemingly secure welfare levels in the hinterland, especially in the Northeast, may be due to the movement of surplus population to the Metropolitan Area. Unless the trend is attenuated the movement will surely become a backwash.

The regression model itself did not perform quite as well as in the Halifax-Dartmouth case. Even so, the regressions were generally very highly significant. The Quebec City region is a more complex and better developed area than Nova Scotia and hence it is possible that the Quebec City region cannot be described as well with a simple regression model. The independent variable st^2 turned up as the one included the fewest times by the stepwise regression (see table 5-1). The implications of this result have been discussed in Chapter Four.

ANALYSIS OF VARIANCE RESULTS

A one way analysis of variance and Duncan's NMRT (if the analysis of variance indicated a significant difference between classes of growth rates) was performed on the 10 year occupation growth rates for the nine occupation classes. The approach and methodology is the same as outlined in Chapter Four.

CITY SIZE LESS THAN 2000

The mean occupation growth rates and simple correlation coefficient of eight occupation sub-classes growth rates with total occupation growth rates have been calculated and listed in tables 5-3 and 5-4.

TABLE 5-3

Mean Occupation Growth Rates (%) for Towns with Populations Less than 2000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	27.17	7.13	14.92
Agricultural	-23.23	-14.70	5.72
Other Primary	44.48	-3.00	-24.61
Manufacturing and Mechanical	48.67	66.18	-15.80
Transportation and Communication	85.54	-22.29	57.98
Professional	18.58	26.64	46.31
Service and Recreational	-12.93	21.04	50.84
Trade and Finance	72.69	14.50	-14.89
Clerical	109.03	55.62	111.19
Number of Observations	16	16	21

TABLE 5-4

Simple Correlation (r) of Total Occupation Growth Rates vs. Eight Sub-Groups for Towns with Populations Less than 2000

Occupation Sub-Groups	Total Occupation Growth Rates		
	1941-51	1951-61	1961-71
Agriculture	-0.267	0.530*	-0.056
Other Primary	0.213	-0.206	0.228
Manufacturing and Mechanical	0.640*	0.574*	0.593*
Transportation and Communication	0.579*	0.535*	0.115
Professional	-0.036	0.699*	0.532*
Service and Recreational	0.1529	0.546*	0.459*
Retail Trade and Finance	0.432	0.070	0.501*
Clerical	0.314	0.623*	0.235

*Significance $\geq$ 5% level.

1941-1951.- From 1941 to 1951 the NMRT indicated that only Clerical occupations had a growth rate in excess of the mean overall occupation growth rate. It showed no specific relationship to total occupation growth rates. Growth rates of Transportation and Communication occupations and Manufacturing and Mechanical occupations showed moderate and strong positive relationships with Total occupation growth rates.[6]

[6] These two occupation growth rates were the second and third largest.

The 10 years from 1941 to 1951 were marked by growth rates in Communications and Manufacturing occupations which tended to be above the mean total occupation growth rate in cities with high overall occupation growth rates (overall growth in occupations greater than 16.5% and 22.5% respectively). All small cities experienced positive growth in Clerical positions, probably in a response to growth in Manufacturing and Professional service growth experienced in all towns (especially the medium and large cities, see tables 5-5 and 5-7) during this time period. Agricultural occupations showed a decline that continued until 1961.

1951-1961.- During the decade 1951-61 growth rates in Manufacturing and Clerical occupations were moderately associated with the total occupation growth rates of cities. Above average growth in these occupations tended to occur in cities with overall growth rates greater than 15% and 14.25% respectively. Although the growth rate of Clerical occupations was halved from its 1941-51 level it was still the second fastest growing occupation. During 1941-51 Clerical growth rates were randomly distributed among all cities. Now that the growth had slowed above average growth in Clerical occupation was associated with cities whose overall occupation growth rate was twice the average rate; Clerical growth had become more selective. Growth in Professional and Service related occupations was now (respectively) strongly and moderately related to cities whose overall growth rates were greater than 25.5% and 14.25%. Although Agricultural and Transportation and Communication occupations were on average declining they showed moderately strong tendencies to have higher growth rates in more rapidly growing centres. Positive growth in these occupations tended to occur

where overall growth rates exceeded 15% and -0.75% respectively. Apparently growth became focused on the more quickly growing cities. Only Trade and Finance and Other Primary growth rates were not directly related to high city growth rates. Agricultural occupations showed positive growth in cities whose overall growth rate was twice the 1951-61 average. Growth in transportation and related trades came to a near standstill with some cities showing great declines which turned the average negative.

From 1951-61 small cities continued to broaden their manufacturing sector and infrastructure. As well they began to improve their Service and Professional sectors. This process generally occurred more quickly in the rapidly growing cities.

1961-71.- Throughout 1961-71 only one positive growth rate, the Professions growth rate, had a significant relationship (a moderate one) to overall growth rates. Rapidly growing small cities (overall growth rates greater than 12.05%) were still expanding their Professional services at above average rates. On average, Manufacturing and Trade and Finance occupations were on the decline. Only the more rapidly growing centres (with total occupation growth rates twice the average) tended to have gains in Manufacturing and Trade and Finance occupations. Positive growth rates in these occupations tended to be linked to fast growing localities (mean growth rates greater than 7.5% and 29.3% respectively). The three highest average growth rates (according to the NMRT) were Clerical, Transportation and Communication and Service and Recreational and they tended to occur randomly with respect to the rates of overall occupation growth. Growth

in Clerical, Transportation and Service occupations had no particular relationship to overall growth rates.

1941-1971.- The pattern for cities with population less than 2000 tended to general growth in occupations related to the Service, and Clerical sectors of the economy. Growth in occupations related to the Transportation and Communication infrastructure, Manufacturing sector and the Professions tended to be higher as the overall growth rate of a city increased. In many case cities of low but still positive growth rates experienced a decline in Manufacturing, Trade and Finance and Transportation and Communication occupations. Growth in these three classes would take place only if certain nimum growth impulses (rates of growth) were being generated within a small city or if it was reacting to the growth of the pole. Future research could be directed at answering the question whether the minimum growth requirements originated from internal or external growth impulses.

Average total occupation growth rates fluctuated between 7.13% (1951-1961) and 27.17% (1941-1951). In each of the three decades the mean Total occupation growth rate was smaller than the rate observed for medium and large cities.

CITY SIZE BETWEEN 2000 AND 5000

As in the previous section, mean occupation growth rates and the correlation coefficients of total growth rate with eight sub-groups were calculated. They are listed in tables 5-5 and 5-6.

TABLE 5-5

Mean Occupation Growth Rates (%) for Towns with Populations Greater than 2000 and Less than 5000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	32.04	33.14	28.86
Agricultural	-19.73	-19.00	115.25
Other Primary	43.35	6.63	51.78
Manufacturing and Mechanical	37.74	63.56	-6.78
Transportation and Communication	79.00	15.01	23.67
Professional	39.53	69.16	67.09
Service and Recreational	-2.00	81.06	60.39
Trade and Finance	112.08	44.14	11.21
Clerical	97.59	93.99	83.20
Number of Observations	17	22	22

TABLE 5-6

Simple Correlation (r) of Total Occupation Growth Rates vs. Eight Sub-Groups for Towns with Populations Greater than 2000 but Less than 5000

	Total Occupation Growth Rates		
Occupation Sub-Groups	1941-51	1951-61	1961-71
Agriculture	-0.079	0.719*	-0.068
Other Primary	0.656*	0.367	0.297
Manufacturing and Mechanical	0.636*	0.012	0.169
Transportation and Communication	0.511*	0.393	0.234
Professional	0.341	0.644*	0.596*
Service and Recreational	0.479	0.314	0.347
Retail Trade and Finance	0.716*	0.636*	0.331
Clerical	0.581*	0.822*	0.516*

*Significance $\geq$ 5% level.

1941-1951.- Of the three largest growth rates (according to the NMRT) Trade and Finance and Transportation and Communication occupation growth rates were strongly related to overall occupation growth rates. Growth in Clerical occupations had a moderate relationship to overall growth. Above average growth in Trade and Finance occupations tended to occur when the overall occupation growth rate of a city exceeded 72.45% and 27.6% in the case of Transportation and Communication growth. Clerical growth was inclined to be above average if a city's Total occupational growth rates exceeded 12.75%. We can conclude that positve growth in these occupations was widespread because in all three cases medium size cities with overall occupation growth rates less than the mean experienced above average growth rates in these three occupations. Growth in Other Primary and Manufacturing and Mechanical occupations demonstrated strong positive relationships with overall growth rates. The NMRT indicated they were not significantly larger than the average of -19.73% growth rate in Agricultural occupations. Their impact and importance remain uncertain at this time due to insufficient accuracy in the growth rate estimates. The only positive rate that varied randomly with respect to overall rates was that of Professional occupations; it was positive for all cities.

The 1941-1951 growth patterns indicated that cities which grew quickly tended to grow in most occupation classes and cities that had lagging growth rates experienced slow growth in most occupation classes. The general increase in Professional and Clerical occupations may be an indication of jobs generated by growth in government or an overdue

post-war improvement in the professional services of medium size cities.[7]

1951-1961.- During the 1951-61 period the mean total occupation growth rate for medium size cities changed little from the 1941-51 rate. The NMRT indicated that Clerical and Service and Recreational occupation growth rates were the two largest. Clerical growth had a strong positive relationship with overall growth rates. Cities with decennial total occupation growth rates in excess of 21% (less than the average rate) were inclined to experience greater than average increases in Clerical occupations. Service related occupations grew 81% in this decade but during the 1941-51 decade they showed no growth at all. Their growth rate was not related to Total occupation growth rates. Even cities with negative overall growth rates tended to have positive growth in Service occupations. This would indicate a general surge in service related occupations. The NMRT indicated that the growth rates of Professional, Manufacturing and Mechanical and Trade and Finance occupations were not significantly different. Growth in the Professions and Trade and Finance was strongly tied to overall growth rates. If a city had an occupation growth rate in excess of 21% and 12% respectively it could expect above average growth in the above two occupation classes. All medium sized cities showed positive growth in Manufacturing occupations, regardless of their overall growth.

During the second decade above average growth in the Professions, Clerical sector and Trade and Finance showed an affinity for centres with

---

[7] The correlation analysis showed a very strong direct relationship between Professional and Clerical occupation growth rates.

higher overall growth rates. In all cases though, 'higher' did not mean above average. This would seem to indicate a general improvement in the social infrastructure and administrative sector of the region. General growth occurred in occupations related to the Service and Manufacturing sectors. The regression equations for these two occupation groups did not show substantial gains from 1951 to 1961 therefore we conclude that the growth in occupations must simply have kept pace with population growth whereas growth in Clerical, Professional and Trade related occupations exceeded population growth. The NMRT suggested that average growth rates in Transportation, Primary and Agricultural occupations were near zero and hence may have had little overall impact on the region.

1961-1971.- The analysis of variance revealed no significant difference among any of the 1961-1971 growth rate classes for medium size cities. The relationship of growth rates in Clerical occupations to overall city growth weakened to a moderate positive one. Cities with over all rates greater than 19.65% could expect above average growth in Clerical occupations. Only one city in the medium size class failed to show a positive Clerical occupation growth rate. For the first time Professional occupation growth rates were moderately related in a positive way to overall city occupation growth rates. Above average growth generally occurred in cities whose occupation growth exceeded 13.56%. In other words, a general increase of Professional services had begun for the medium size cities as even cities with below average overall growth tended to experience above average Professional occupation growth. Outside of these two occupation classes occupation growth rates varied

randomly with respect to overall growth rates. In all cases but Agricultural, Primary and Manufacturing occupations a general increase occurred in the number of occupations in almost all cities but only Professional and Clerical occupations appeared to grow in excess of the absolute 1961-71 population growth (see figures 5-5 and 5-9).

1941-1971.- The 30 year trend for medium size cities and the regressions (for all cities) indicate occupation increases in excess of population growth for Professional, Clerical and Trade and Finance occupations. Indications are that medium size cities drew their growth from the expansion of Quebec City as a focus of government, Professional and Trade and Financial and Clerical functions.

CITIES LARGER THAN 5000

The mean occupation growth rates and correlation of total occupation growth with eight sub-groups are listed in tables 5-7 and 5-8.

TABLE 5-7

Mean Occupation Growth Rates for Towns with Populations Greater than 5000

Occupation Class	1941-51	1951-61	1961-71
Total Occupations	48.40	67.44	36.48
Agricultural	-7.03	46.13	99.51
Other Primary	116.20	82.45	101.20
Manufacturing and Mechanical	40.33	104.48	-15.82
Transportation and Communication	77.33	44.67	25.48
Professional	75.07	115.96	72.63
Service and Recreational	-3.28	90.01	51.67
Trade and Finance	123.63	101.69	32.88
Clerical	127.86	112.66	73.51
Number of Observations	11	18	19

TABLE 5-8

Simple Correlation (r) of Total Occupation Growth Rates vs. Eight Sub-Groups for Towns with Populations Greater than 5000

Occupation Sub-Group	Total Occupation Growth Rate		
	1941-51	1951-61	1961-71
Agriculture	0.472	-0.082	0.300
Other Primary	-0.128	0.566*	0.455
Manufacturing and Mechanical	0.826*	0.947*	0.671*
Transportation and Communication	0.776*	0.970*	0.588*
Professional	0.892*	0.972*	0.776*
Service and Recreational	0.960*	0.961*	0.870*
Retail Trade and Finance	0.968*	0.987*	0.903*
Clerical	0.740*	0.960*	0.955*

*Significance $\geq$ 5% level

1941-1951.- The analysis of variance indicated that 1941-51 occupation growth rates classes were not significantly different from each other. What appear to be high average rates for Other Primary, Trade and Finance and Clerical growth were created by isolated extreme values in the data set. After removing the extremes the rates were reduced to approximately -15%, 75% and 64% respectively. Primary growth rates were not related to overall growth rates. Trade and Finance and Clerical growth showed a strong tendency to be above average when overall city occupation growth rates exceeded 45% and 24% respectively. Growth rates in Manufacturing

and Mechanical, Transportation and Communication and Professional occupations showed strong tendencies to above average growth in cities with overall rates exceeding 54%, 6% and 21% respectively. Only Manufacturing required above average overall city occupation growth to have above average growth itself. All other growth rates occurred among large size cities without demonstrating any particular relationship to overall occupation growth rates.

As was the case with small and medium size cities occupation gains common to almost all cities were those related to the Professions, Clerical positions and Finance. Manufacturing was an exception. Significant growth was restricted to large cities with high occupation growth rates. Where small, medium and large size cities appeared to have occupation growth in excess of population growth in Clerical, Professional and Trade sectors (see figures 5-6, 5-8 and 5-9) large cities may have added Manufacturing growth in excess of population growth as one of their leading sectors. Large centres apparently react to increases in the scale of government and may have experienced growth in Manufacturing occupations as a response to increased consumer demand created by the overall regional population and economic growth which are themselves related to expansion in the activity of the pole. Small and medium size cities apparently could not develop a Manufacturing sector as they lacked i) the potential for scale economics, ii) strong and consistent internal growth[8] and iii) a large enough local hinterland for a market.

---

[8] Total occupation growth rates for large cities were always greater than the overall growth rates of small and medium cities.

1951-1961.- According to the analysis of variance no significant difference existed among any of the 1951-61 growth rates. The regression line (for all cities) indicates a reduction in Total occupations per person levels from 1951 to 1961. This suggests that as a rule classes of occupation growth have lagged behind population growth. The only occupation not to associate its rates of growth with overall city occupation growth rates was Agriculture. Agricultural occupation growth rates for the sample cities varied between -60% and 100% without regard for overall occupation growth rates. Other Primary occupations appeared to be growing quickly but the average was severely effected by two extreme values; in general its growth rates tended to be between -50% and 30%. Cities with overall occupation growth rates greater than 7.5% showed a moderate tendency to have positive rates of growth in Primary occupations. All other occupations classes showed strong tendencies to associate above average growth with cities of higher overall growth rates. Of the remaining occupation classes (Manufacturing and Mechanical, Transportation and Communications, Professional, Service and Recreational, Trade and Finance and Clerical) between 89.78% and 97.38% (r^2) of the variation in occupation class growth rates was explained by overall occupation growth rates. These were by far the strongest relationships found yet.

The Manufacturing and Mechanical average was inflated by an extreme value. Most rates ranged between 0% and 150%. Above average Manufacturing and Mechanical occupation growth rates were generally associated with cities whose overall occupation growth rate exceeded 45%. Above average Professional growth was associated with overall rates greater than 15%, and above average Clerical growth with overall rates exceeding 4.5%.

Transportation and Communication, Service and Recreation and Trade and Finance average growth rates were inflated by two extreme values. In most cities growth rates for these occupations ranged between 0% and 100%.

The 1951-61 pattern demonstrated overall growth in all occupations but the growth was possibly less than absolute population growth (see figure 5-1). Above average growth levels in almost all occupations were associated with faster growing cities but faster did not mean greater than the overall average occupation growth rates. This indicated that there might have been a general growth trend in these occupations throughout the region in response to some regional, provincial or national trend and not necessarily associated with above average internal growth in a given city.

Two cities within 10 miles of Quebec City, St. Foy and Charlesbourg, became receptacles for growth spilling over form Quebec City. These two cities were the extreme values mentioned above (with extraordinarily high Total, Manufacturing and Mechanical, Transportation and Communication, Professional, Service and Recreational, Trade and Finance and Clerical occupation growth rates). All large cities nearest Quebec City had, on average, higher occupation growth rates but the regression of Total occupation for all cities (figure 5-1) suggests that absolute population growth may have exceeded absolute occupation growth near Quebec City even though all city sizes had positive occupation growth rates during 1951-61. Beyond a 60 mile limit to the Northeast and beyond 50 miles towards Montreal absolute increases in occupations appeared to outstrip population increases (see figure 5-1).

1961-1971.- According to the analysis of variance none of the 1961-71 growth rates groups were significantly different from each other. Professional, Service and Recreational, Trade and Finance and Clerical occupation all showed strong positive relationships with overall occupation growth rates (but r^2's, ranging between 0.6023 and 0.9126, were slightly lower than for 1951-61). Transportation and Communication occupation growth rates had a moderately strong and direct relationship with overall growth. The high mean growth rate in Agricultural occupations was due to extremely high growth in Montmagny (1141.67%) and Grandmere (533.33%). Each exists as an isolated situation and not part of a pole related trend. Transportation and Communication, Professional and Trade and Finance occupations tended to have above average growth rates in cities with overall occupation growth rates over the 6% to 10% range. In other words, these occupations as a group tended to grow at above average rates as long as the city continued to grow overall (even at a rate well below average). This suggests a concentration of growth in Professional, Trade and Finance and Transportation and Communication occupations in the region which offset the mixed results of other occupation classes. The result is an average total occupation growth rate of 36.48% (for large cities). Above average growth in Service and Recreational and Clerical occupations tended to occur when overall growth was beyond the range of 26% to 32%. Only four cities, Charlesbourg, St. Laurent, Plessisville and Montmagny, experienced positive growth in Manufacturing and Mechanical occupations from 1961 to 1971. These cities tended to have overall growth rates greater than the average for large cities.

1961-71 demonstrated a continuation in the trend to increases in Professional, Service, Financial and Clerical sectors which were presumably attached to the provincial government's growth in Quebec City. Manufacturing and Agricultural growth occurred only in selected centres, probably as a response to local demand related to population growth and/or ideal local conditions and location near a market. The individual regressions of Manufacturing and Mechanical and Agricultural occupations per person (for all cities) supports this conclusion. Per capita Agricultural occupations were best sustained towards the fringes of urbanized areas and Manufacturing and Mechanical occupations per person showed no spatial or temporal relationship to the pole; an indication of its sporadic and location specific growth. The regression of Total occupations per person suggests that occupation growth followed behind population growth near the pole but tended to exceed population growth at increased distances from the pole.

If the pole is the cause of the occupation per person growth beyond 40 to 45 miles than it appears the pole is acting as predicted.

CONCLUSIONS RE: QUEBEC CITY AND THE POLE REGION

In the main growth in absolute numbers of occupation took place in the Service, Clerical, Professional and Trade and Finance sectors. Over the 30 year time period small cities (less than 2000) experienced continued growth in Clerical and Professional occupations. Medium size cities experienced continued growth on a broader base, with steady 30 year growth in Transportation and Communication, Professional, Trade and