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Population changes in Ontario towns and villages, 1941--1966.

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Population Changes in Ontario Towns and Villages 1941-1966

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This thesis was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It is a partial fulfillment of the requirements for the degree of Master of Arts.

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Supervisory Committee

Chairman

For Carol, Kari and my parents

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Abstract

Population Changes in Ontario Towns and Villages

During the last 40 years a certain body of knowledge has been developed from the investigation of the growth of towns and villages. Investigators have found that the growth of places is strongly influenced by certain factors such as size of place (Radcliff, 1942; Brunner, 1944, 1951; Stoeckel and Beagle, 1969), size of nearest large centre (Bracey, 1958; Fuguitt, 1963; Hart and Salisbury, 1965), distance to nearest large centre (Lowry and Jacobson, 1941; Duncan and Reiss, 1950; Fuguitt and Butler, 1970), employment by occupational groups (Thomas, 1960; Northam, 1963; Beale and Tarver, 1968). This study is an attempt to verify these particular variables within the area of Ontario.

Three time periods from 1941 to 1966 were utilized to examine the effect of factors individually and according to specific groups on the growth of Ontario towns and villages located within a 30 mile radius of a major centre. Places containing populations of less than 10,000 were divided into three size classes - 0 to 1,000, 1,000 to 2,500 and 2,500 to 10,000. From a general investigation of all towns and villages with populations of 0 to 1,000, the study proceeded to an investigation of each size class. This provided a more specific analysis of variables influencing centres of

different size classes.

Individual variables were matched against the dependent factor, percent population growth, in a stepwise multiple correlation program. From the program a matrix correlation table and a stepwise summary table, which accounted for the variation due to growth for variables separately and cumulatively, were made available. The variables were then grouped into three categories representing urban shadow (distance to and size of nearest large centre), regional location (nine Ontario regions) and employment by occupations (primary, blue collar and service). Also obtained from stepwise correlation program were residuals from regression for all towns and villages. Residuals greater or less than $\pm$ .75 level were examined in order to discover causes for their population increases or decreases.

Results from the study showed the overriding importance of distance to and size of nearest large centre (urban shadow) in affecting population growth when places in the 0 to 10,000 population range were considered. Only once did the size of place variable prove to be of importance during the period 1961-1966. This was caused by pronounced differences in growth among the three size classes which witnessed, consecutively, increased percent population gains from the smallest to the largest size class.

For individual size classes, greater factor variation was evident. In the 0 to 1,000 size category, the urban shadow variables decreased in importance from 1941 to 1966, while the regional location became increasingly dominant. An

increasing mean distance from 1941 to 1966 for these villages revealed a locational movement outwardly from nearest dominant centre. By 1961, loss of places within close commuting distances of large centres to the 1,000 to 2,500 size class resulted in fewer villages located close to major urban areas. Instead, regional location of such areas as St. Clair and Georgian Bay was becoming important in influencing village growth. Expansion of industries such as auto manufacturing, agricultural processing and recreation were important stimuli affecting village growth in various regions.

The strongest influence in the 1,000 to 2,500 size category, distance to and size of nearest large centre (urban shadow), proved to be relatively stable temporally. A large number of these places, particularly after 1951, were found to be commuting or recreation centres located in close proximity to large cities. Means showed these centres to have the shortest distances to the nearest dominant centre.

Greatest variable fluctuations were exhibited in the size class 2,500 to 10,000. The urban shadow effect of distance to and size of nearest large centre accounted for greatest percent variation due to growth during the periods 1941-1951 and 1961-1966, while regional influence dominated during the decade 1951-1961. Fluctuations were attributed to the economic structure of these places which often were industrial extensions of large cities such as Toronto, Windsor, Hamilton and Kitchener-Waterloo or were in autonomous locations, relying on regional economic conditions such as agriculture, recreation or a local resource. During the decade

1951-1961, the urban shadow influence was effectively weakened because of exclusion of annexations by towns noted to be industrial extensions of large cities. Moreover, the tendency for dispersion of manufacturing away from large cities to places located at distances approaching 30 miles caused a rapid growth of centres at these outlying locations.

Residual centres greater or less than ± .75 were not adequately explained by the postulated factors and were the result of other possibly unknown variables. Investigation of these places revealed certain locational distributions while made it possible to group them by their economic bases. Examples of rapid growth centres were commuting places in close proximity to larger cities, recreation centres near large urban areas and manufacturing towns, often extensions of large cities. Overpredicted places with slower growth or declining populations were agricultural trade centres located in poor agricultural districts and, at greater distances from urban concentrations, competing centres, receiving competition from a larger community in close proximity and, finally, resource places which grew according to market demands for their minerals or goods.

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Chapter I

Introduction

The growth and decline of population in small centres has long been of interest to social scientists. Population losses or gains in such places cause social, economic and structural planning problems. This interest, then, has resulted in increased attention to factors responsible for variations in growth. In particular, geographers have manifested their interest in spatial distribution of towns and villages and the causes responsible for these variations. A multitude of factors such as distance, size, location and economics have been studied and analyzed in order to find the most important.

In the United States some of the more recent studies in population geography and rural sociology have investigated causes of population change in villages and towns. The Midwest, South and North Central regions, as used in the United States Census, have been examined by Hart and Salisbury (1965), Tarver and Beale (1968), and Stoeckel and Beagle (1969). Similar internal characteristics of demographic, economic, physical and locational nature have been examined within these areas to determine certain common factors causing growth.

In Canada, Hodge also has investigated centres in a

relatively uniform area in the Great Plains (1966). Yet some areas of internal spatial diversity remain to be studied. The province of Ontario is one such area possessing considerable internal diversity, physical, social and economic in nature (Watson, 1968; Ray, 1965). Such a region provides a test case for certain established variables.

It is the purpose of this thesis to attempt to explain the 1941-1966 numerical population changes of Ontario towns and villages employing five selected independent variables: size of place, economic location, size of nearest large centre, distance to the nearest large city and occupational groupings. In addition, the factors will be compared individually as well as collectively in order to determine their effect on the growth of small centres. The grouping will take into account the variables reflecting urban shadow,* distance and size of nearest large centre, regional location (nine regions) and occupational structure (primary, blue collar and service).

Review of Literature

The literature dealing with population growth and decline of small places has grown immensely in the last thirty years. The emphasis has shifted from studies less analytical and less complex to more exacting statistical approaches.

*The urban shadow effect refers to the dominance or influence of the nearest large centre on surrounding towns and villages. In order to measure this influence, distance to and size of nearest large centre must be known.

Early studies utilizing contingency tables and maps were able to show certain factors such as distance or size, causing growth or decline. Such relationships, however, were only broad and did not distinguish the degree to which individual factors were responsible for change.

More recent works employing statistical techniques have helped to clarify this situation with the use of simple stepwise correlation and factor analysis programs. These programs enable the examination of any number of variables that can be measured individually and aggregately in order to ascertain their significance and comparative importance.

This study will review the literature temporally, according to five individual variables: distance to nearest large centre, size of place, size of nearest large centre, economic location and occupational divisions.

1) Distance to Nearest Large Centre

Lowry and Jacobson (1941) recognized the importance of distance from major trade centres as an important factor affecting growth or decline of the small trade centres. Using four 5 mile constructs around each major centre, the authors discovered that an increase in distance resulted in a decrease in growth in the 1915-1929 period. During the depression years, 1929-1937, this relationship changed as centres in different zones varied greatly in growth and decline.

With travel becoming faster and commuting more popular during the 1950's and sixties, an increasing number of studies examined the effect of distance from a larger centre.

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Duncan and Reiss (1950) asserted it to be one of the variables causing growth differences among communities in the United States. Using larger centres of 2,000 to 4,999 and 5,000 or more, Hassinger (1957) examined the population change of smaller municipalities in Minnesota located within constructs of 7 miles, 15 miles and more than 15 miles. He discovered that the average size of small incorporated places increased with distance from a larger centre and that increased size was also related to greater growth. The author, after using tests of correlation and chi square, which were positive but low, admitted that perhaps more complex relationships were involved.

A replication of Hassinger's work examines changes in small town population and distance from larger towns in Wisconsin for two decades, 1940-1950 and 1950-1960 (Fuguitt and Butler, 1970). Results proved to be similar to Hassinger's with the association between population change and distance to the nearest large town being negative or non-existent. If the nearest large town was considerably greater than surrounding towns, the relationship proved to be stronger.

Following a similar line of thinking, Northam (1963), in an empirical study based on map analysis, examined population decline or increase of urban centres with 1,000 or more inhabitants in the U.S. between 1940 and 1960. His findings indicated that the declining urban centre was a small town in which distance away from metropolitan complexes resulted in

further decline.

A more recent study analyzed the urban dominance of rural farm status in the U.S. North Central Region (Stoeckel and Beagle, 1969). The two primary factors were cited as influencing the rural population: 1) the distance of the hinterland population to the centre and 2) the size of the urban centre.

2) Size of the Nearest Large City

Closely related to the distance factor and probably one of the most useful factors in explaining small town growth and decline has been the size of the nearest large centre. A number of studies including (Bracey, 1958; Fuguitt, 1964; Hart and Salisbury, 1965; and Tarver and Beale, 1967) have shown that towns near large cities are more likely to grow.

In his study, Bracey found that the greatest losses in the United Kingdom occurred in the parishes located farther from populous urban areas. Fuguitt examined centres in Wisconsin located within 30 miles of three cities having populations of under 10,000, 10,000 to 50,000 and 50,000 or more. The indication was that villages located within fringes of larger cities experienced greater growth. Similarly, Hart and Salisbury discovered that areas of higher village growth were larger urbanized areas of the U.S. Midwest. Dealing with a statistical analysis of Southern U.S. towns, Tarver and Beale found that metropolitan proximity was an important factor in accounting for the rapid population increase in villages and small towns.

None of these studies offered conclusive evidence to explain the reason for greater town growth near large cities. However, a number of studies have dealt with the influence of large cities or urban shadow effect over surrounding communities, showing clearly the influence of many city characteristics into satellite communities (Kish, 1954; Martin, 1957; Schnore, 1957; Mark and Schwirian, 1967).

Kish dealt with the influence of large cities over surrounding settlements. Using personal characteristics (sex, age, labour force, non-white) for places of 2,500 or more as well as dwelling characteristics (monthly rent, dwelling in need of repair), the author discovered varying zones of influence for metropolitan areas of different sizes. A large city such as Chicago would have the same influence at 35 miles that smaller cities might have at 25 or even 15 miles.

An interesting study by Martin discusses the gradient principle, stating that "the extent of urban-influenced changes in rural areas varied inversely with the distance to the nearest city and directly with the size of the city". The author found that the principle was well supported in the 1950's with the greatest increase occurring in the suburban fringes of larger metropolitan places. These metropolitan places exerted a more distant influence on the smaller centres.

In a similar work, Schnore, dealing with the growth of metropolitan suburbs, stressed the reliance of the suburbs on the city. Since many of these surrounding areas had become dormitory towns, growth of these places might rely on prevailing economic conditions within the city which employed

many of the residents.

A more recent study by Mark and Schwirian found that, increasingly, the growth of communities depended on commuters rather than on total town functions which in many cases were declining simultaneously with the growth of the town. The authors, dealing with 98 Iowa communities in 1951 and 1961, discovered that independent centres at the periphery of a metropolitan area were close enough to be influenced but far enough away to maintain economic independence within 30 miles of the central city.

3) Size of Place

It has been agreed in most studies that size of a place or community affected its growth or decline. Many authors have associated decline with smaller places and growth with larger centres. Some of the major contributors have been (Radcliff, 1942; Brunner, 1944, 1951; Northam, 1963, Hart and Salisbury, 1965; Fuguitt, 1964; Fuguitt and Butler, 1970; Hautamaki, 1967; and Tarver and Beale, 1967).

Initial investigations by Radcliff, Brunner, Northam and Fuguitt showed that population changes in small places were positively associated with their initial size. These were only broad relationships, however, and were much less clear in contingency tables than in regression and correlation examinations.

With the advent of the mid-sixties, many studies began to use correlation and regression relationships. In a geographical attempt to examine the size relationship, Hart

and Salisbury found the coefficient of correlation to be .29 meaning that only eight percent of the variation in change could be explained by variation in village size for the mid-western United States. They concluded that factors other than size were responsible for the village decline. Following a similar approach, Fuguitt and Butler discovered a .23 coefficient of correlation which explained that 5 percent of the variation in growth was caused by size of Wisconsin villages. In Finland, Hautamaki also found a positive correlation between size of village and growth. The author, dealing with very few samples (42), produced a scattergram in order to prove the relationship. Examining southern non-metropolitan United States towns, Tarver and Beale were able to attribute 9 percent of the variation in growth to the size variable. The strong relationships stated in early descriptive attempts have been greatly clarified with the increased use of statistical methods which have depreciated the value of size as only one of the multitude of factors explaining growth.

4) Regional Location

Few studies have dealt with the effect of economic location* on the growth of small places. Some geographers attempted cartographically to relate growth or decline of towns and villages to proximity of highly urbanized regions.

Northam (1963) went to great detail to map small declining urban centres in the United States, 1940-1960, by

*This refers to the economic areas or regions within which centres are located.

both choropleth and isopleth techniques. He did not, however, relate areas of declining towns to economic divisions within which such places were located. Mapping villages of the Midwestern United States, Hart and Salisbury (1965) also showed areas of village growth during the period from 1950 to 1960 in relation to urbanization. Even though the authors did establish the fact population change in the Midwest varied geographically, they ignored the economic or regional location. In a similar effort, Fuguitt (1964), while mapping growth and decline in Wisconsin, discovered that growing areas of the state and nation almost always included large metropolitan centres.

Other studies have often listed gains and losses of population by physical region but, for the most part, have not associated these with economic divisions (Brunner, 1951, 1952; Radcliff, 1942).

In a study of a quantitative nature, Johnston (1969) related growth of towns with areas of metropolitan proximity. In order to examine this the author used statistical divisions adjacent to each of the six Australian state capitals. These divisions were expected to be in close economic and social conformity with the principal urban centres for the next several decades. The study, however, does not compare the economic structure of these areas with variations in growth of small towns.

One of the few works which has examined the growth of small towns in different economic divisions has been quantitative (Tarver and Beale, 1968). The 1950-1960 population

changes among 801 centres of 2,500 to 9,999 inhabitants in the Southern Census Region of the Unites States were examined in terms of their location within certain economic regions. Findings revealed nine regional locations to be the second most important factor in explaining numerical population changes. Towns in the Gulf Coast and Atlantic Flatwood Region outgained all places located in eight other economic areas.

5) Occupational Divisions

Economic conditions influence the population growth of an area (Kariel, 1963; Lee, 1970; Porter, 1956; Webb, 1963). If this is true, the economic base of small towns should also affect the differential patterns of numerical population change. General agreement supports the finding that the economic bases of small towns tend to be service-oriented. Stafford (1963) studied small towns in Southern Illinois (1960) and discovered that the economic bases of these places were highly predictable. Such places were found to be primarily service centres. This was upheld by Brunn (1968) who suggested that small places were strongly service-oriented even though some change was appearing with decentralization of industry into small towns.

An interesting study by Hoyt (1961) suggested that growth in the population of any community cannot take place without a corresponding growth in basic employment. Extending the same idea, Northam (1963) concluded that this variable appeared to be highly significant.

Few of these studies proceeded to examine the influence of economic employment structure on the growth or decline of municipalities but instead presented broad generalizations.

Two quantitative articles which dealt with the effect of employment structure on the population growth are by Thomas (1960) and Beale and Tarver (1968). In the first work, Thomas examined areal associations between population growth and nine selected factors in the Chicago urbanized area. The variables employed were size of population, density of population, cost of housing, natural increase, age, quality of schools, number of persons engaged in manufacturing, accessibility from Chicago and the amount of vacant land. Through the use of multiple and simple regression the author found these variables accounted for 36 percent of the variation in growth. Among the most important causes of growth was the number of persons employed in manufacturing. Cities with greater numbers in manufacturing experienced greater growth between 1940 and 1951 than cities in which there were fewer engaged in manufacturing.

Beale and Tarver dealt with the relationships of changes in employment to the population changes of 762 southern nonmetropolitan towns. Increases in the total number of employed civilians in 12 major industries accounted for 85 percent of the variation in the 1950-1960 numerical population changes in southern towns. Manufacturing exerted the greatest influence of the major industries. This technique raises doubt as to whether it is necessary to compare population changes to other criteria such as economic change.

Since any economic alterations will reflect population change and vice versa, both variables are strongly complementary. High assocations can easily be predicted between the two variables as was demonstrated by Beale and Tarver. A substitution of an increase in employment for population change could be made with this variable becoming the dependent factor. To avoid this development, this thesis will employ actual employment in occupational sectors during the base year.

Multi Factor Analysis

With the increased use of statistical methods in recent years a number of studies previously mentioned have studied the interrelationships between factors. Techniques such as multiple stepwise regression-correlation can yield the percentage of variation in growth or decline answered by variables, individually and aggregately.

Fuguitt (1964), employing gamma tests of association, discovered village and town size in Wisconsin to be less influential compared with location relative to large centres and non-village growth in the area. Hart and Salisbury (1964), in a more refined quantitative study, examined variables of distance to the nearest city, village size and state in which the village was located. Using multiple correlation, the first two variables individually explained 16 percent and 6 percent respectively and together 22 percent of the variation in change. For state location, the authors applied a separate test of variance which indicated some states to be growing more rapidly than others.

A more comprehensive factor analysis of growth by Tarver and Beale (1968) used four selected independent variables: 1) regional location, 2) county seat status, 3) distance to nearest dominant metropolitan and 4) size of the place in 1950. Findings showed that only two variables explained appreciable proportions of the variance in the 1950-1960 population changes; first, population size in 1950 and second, economic region. Altogether, the four variables explained only 17 percent of the variation in population changes of southern towns.

In a brief article, Johnston (1969) found three factors to be of importance in the population change of small Australian towns from 1961-1966: initial size, metropolitan proximity and rural population change. Although he indicated all the aspects of quantitative work, the author failed to give any interrelationships between variables.

Canadian Literature

In the Canadian literature, little has been attempted in order to study the causes affecting town and village growth. A number of studies, strongly historic in nature, deal with the movement of settlers into an area and the subsequent establishment of settlements. Some studies deal with changes in distribution and the establishment of more small centres resulting from the movement of more settlers into an area. These villages become small service centres supplying surrounding farming districts. As basic industry moved into these places, a specific road pattern was established to serve the area. The advent of the railroad again caused changes with

the centres located on a rail line growing very quickly. Finally, with the growth of large cities, increased velocity of the automobile and more modern roads, a reorientation of population in small places occurred. Economies of scale resulted in the loss of small industries to large centres. Centres within immediate sphere of large cities grew and those in less accessible areas lost population to the large urban areas. Studies which have proceeded along such lines were concerned with Southwestern Ontario, the Ausable watershed, the Listowel region and the Nipissing area of the Canadian Shield (Watson, 1947; Nicholson, 1951; Kirk, 1947; and Rumney, 1951).

Other Canadian studies have dealt with settlements of ethnic and cultural groups. These studies are also historical in nature with some emphasis on the environment and its effects on such peoples as Eskimoes, Finlanders, Nova Scotians, the Dutch and the Mennonites (Robinson, 1944; Van Cleef, 1952; Hobson, 1954; Sas, 1957; Warkenton, 1959), but they seldom touched upon the dynamics or mechanics of growth.

More recently, two articles pertaining to growth and decline of population settlements have used empirical and statistical techniques for analysis (Hodge, 1965, 1966). The first of Hodge's articles consisted of two sections: inductive and deductive. It dealt with the changes in the trade centre system in the Great Plains, 1941-1961. In the first part, 906 trade centres in Saskatchewan during 1941 were studied using percentage tables. Findings of interest in this study indicated that low ranking retail centres lost

population more rapidly than higher ranking trade centres. The density of small trade centres in both 1941 and 1961 decreased while the rate of decline increased with increasing proximity to large centres. Other characteristics considered the spacing of trade centres. The inductive analysis using factor analysis was based on the possibility of predicting centre decline. From this, three factors of importance were derived: urban size, farm size and urban density, accounting for 60 percent of the variance in the factor matrix. Using change in retail service level from the years 1941-1961 as the dependent variable, the position of a centre in each of three factors was treated as an independent variable. From this, the inductive method provided a potential of predicting future trade centre performance.

In his second paper on village growth in Saskatchewan, Eastern Ontario and Prince Edward Island, Hodge found the disappearance and decline of many trade centres within all these regions. Indications were that smaller centres declined at faster rates than larger ones and that the effect of larger centres on nearby smaller ones appeared to be significant for Saskatchewan but not for Ontario or P.E.I. In his final statement, the author predicted the decline of 'convenience' centres. As certain centres declined, rural people would have to travel longer distances for services, and many small trade centres within a radius of ten miles of large trade centres would disappear so that most small trade centres would be located more than 15 miles away from a large trade centre.

Methodology

Three time periods from 1941-1966 for which sufficient data were available were chosen from the Canada Census. These consisted of two decades between 1941 and 1961 and one five year period from 1961-1966, the last date of census taking. Within each time period the percentage growth of 192, 179 and 192 incorporated Ontario towns and villages was computed. The variation in number of centres per period has resulted from the exclusion of areas where annexation occurred. Because the annexation of peoples is a political increase and not a natural or migrational one, it is therefore excluded.

All places located within thirty miles of major cities were chosen for the study. This radius has been considered a commuting distance within reach of large cities (Fuguitt, 1964). Moreover, from empirical analysis it was observed that centre growth beyond this distance was little affected by the nearest large city. Centres located within the thirty mile radius were divided into three size classes, 0 to 1,000, 1,000 to 2,500 and 2,500 to 10,000, in order to study characteristic growth patterns. Choice of the first class was made according to the Canadian definition of an urban place, any centre comprised of 1,000 or more inhabitants. The second size category was chosen as an urban place which has not yet achieved town status at the 2,500 population level. In the third category a wide range was necessary to ensure a sufficient number of sample towns. All three size groups have

been used previously in studies dealing with population (Radcliff, 1942; Hassinger, 1957; Tarver and Beale, 1969; plus numerous other Ontario Regional Studies).

To measure the influence of the nearest city, actual road distance and population size were employed. Road distances were tabulated from an official Ontario Department of Highways map. If a centre were located at a similar distance from two large urban areas, it would be relegated to the larger of the two. However, few such cases were encountered. For the size of the nearest city, the base years 1941, 1951 and 1961 of each period were utilized to find the effect of this factor on growth or decline. This method was duplicated for town and village size.

Since people tend to move towards areas of greater economic opportunity (Stone, 1967; Kogler, 1969), towns and villages in such an area should experience increased growth while, inversely, slow growth or even decline should be prevalent in a region of less opportunity. For this study, nine Ontario economic regions will be employed, according to delineations made by Camu, Weeks and Sametz (1964).

Although these divisions are generalizations representing a rationally conceived and widely accepted scheme of regionalization in Canada* these represent "the best possible combinations of structural, functional, production and marketing factors". (Camu, Weeks and Sametz, p265, 1964) These regions are based primarily on economic-functional criteria, rapid

*This system of Ontario regions has been found useful by the Ontario Department of Economics and Development for their regional studies in order to develop schemes of regional planning.

growth of centres should be relatable to economic developments occurring in such areas. It then becomes useful and valid to relate growth of places to the region within which they are located. Once the influence of these divisions is determined, the relative economic developments can be examined to discover further causes for centre growth. Due to a small number of sample places in the two northern divisions (northwestern and northeastern) these units were grouped into one northern economic division.

The location of the different economic regions should affect the numbers employed in certain occupations. In turn, growth should be influenced by types of labour divisions. To test this hypothesis, occupational employment in villages and towns was divided into three categories: the primary sector, including agriculture, mining and others, the blue-collar category including manufacturing and mechanical, construction and labour and the service sector, including professional, clerical, transportation and communication, commerce and finance and direct services. Census data for occupational divisions were available for each place with a population of 1,000 or more while for centres under 1,000 only non-farm county figures were obtainable. County data should reflect the occupational divisions for small places of less than 1,000 population.

In order to simplify the large amount of data available for the five factors, a stepwise multiple correlation program was run. This had the advantages of making available a matrix correlation table which correlated all variables, a summary

table which presents the most important variables with their cumulative percentages and residuals for each centre.

Residuals are values arrived at from the general form of the regression equation $Y = a + bX$ when Y is the value of the dependent variable, X is the value of the independent variable, a is the value of Y when X is zero and b is the value by which Y increases for each unit of increase in X. This equation can be used to predict the percentages by which the population should have changed for a centre of any size in a base year between two time periods. In this study, investigation of residuals might suggest variables not being utilized.

> In most geographical analysis there is considerable unexplained variation and the residual values can be interpreted as reflecting in part the effect of other possibly unknown variables. The locational arrangement of residual values will suggest other variables which might be important in accounting for the remaining variation in the dependent variable (King, 1969).

In effect, residuals in this study are centres which lie outside the standard error band and have either failed to grow or have exceeded the normal predicted population increase. The standard error band will be the .75 level and centres which lie more than +.75 or less than -.75 will be examined. The advantages of this level are (a) more centres will be included thereby aiding in the discovery of any map patterns and (b) such places are close enough to the ± .1 standard deviation so that they do, in fact, display unusual growth.

Once these centres were identified, it was necessary to discover the causes for such growth. Since field work was

limited due to time shortage, size of the study area and the number of centres involved, other sources had to be sought. These were: (a) histories of counties and centres and (b) economic regional studies. From these readings, economic structure and often reasons for unusual growth were provided. This enabled the grouping of centres displaying similar economic bases in order to discover common causes of unusual growth.

Chapters two to four, in dealing with the three time periods, follow a similar procedure. In each, an examination of variable and residual results will be made for all Ontario towns and villages within the population range of 0 to 10,000. A comparison of the means and standard deviations of percent population growth, distance and occupational groupings follows. This will aid in explaining class findings. As in the 0 to 10,000 population range, residuals for the three classes are included. The last segment of these chapters offers a comparison of the three classes.

The fifth chapter compares individual and component variables in each class to ascertain their temporal stability and effect on growth of Ontario towns and villages. Places whose growth was not explained by these variables are also discussed and grouped according to their economic base. In the final sections, applied uses and future studies are suggested.

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Chapter II

Population Changes During The Period 1941-1951

Ontario witnessed a rapid increase in population during the decade 1941-1951, especially after termination of the war when a large influx of immigrants and a high rate of natural increase took place (Dominion Bureau of Statistics, p4, 1961). Many of these people were readily absorbed into the expanding labour force within the urban sector of Ontario.

> The second world war led to a phenomenal expansion in manufacturing. This expansion concentrated itself primarily in the cities and larger towns. (Spelt, J., p182, 1955)

This concentration of manufacturing and labour consequently affected the growth of smaller surrounding centres to the extent that a high mean population gain of 18.8 percent was recorded. Examination of the correlation matrix revealed that size of and distance to nearest large centre and the Central Ontario region were significantly correlated with the population growth of centres (Table 1). A negative correlation on the distance variable meant that as distance from the nearest large centre increased, the population growth of towns and villages decreased.

When intercorrelations between variables were removed by the stepwise analysis, size of the nearest place and distance emerged as the two most important factors. These two indices

which are functions of urban shadow dominance accounted for 28.5 percent of the explained variation in population growth of Ontario towns and villages (Table 2). Compositely, 11 variables answered 40 percent of the variation due to growth. The regional effect which appeared to be of importance on the correlation matrix was responsible for only 10 percent of this variation. St. Clair, Niagara and Central Ontario were the most important of the nine regions, all three having experienced rapid rise in manufacturing during this period: St. Clair in automotive and chemical, (Ontario Department of Economics and Development, 1967) Niagara in iron, steel and textiles, (Powell, J. and Coffman, B., 1956) and Central Ontario in a variety of manufacturing goods, (Spelt, 1955).

Table 1

Correlation Matrix 1941-1951

Variable		
2	Size of place	.128
3	St. Clair Region	.202
4	Lake Erie Region	.011
5	Niagara Region	.154
6	Midwestern Region	-.008
7	Georgian Bay Region	-.207
8	Central Ontario Region	.319*
9	Eastern Ontario Region	-.171
10	Lake Ontario Region	-.181
11	Northern Ontario Region	-.090
12	Population of nearest large centre	.411*
13	Distance to nearest large centre	-.349*
14	Percent employed in primary sector	-.096
15	Percent employed in blue collar sector	.035
16	Percent employed in service sector	-.040

*Significant at .05 level

Table 2

Stepwise Summary Table 1941-1951

Variable Entered	Multiple R	RSQ
12	.410	.168
13	.534	.285
3	.581	.337
5	.593	.352
4	.604	.365
6	.611	.374
8	.619	.384
2	.626	.392
14	.627	.393
15	.629	.396
16	.633	.401
7	.634	.402
11	.634	.402
9	.634	.402

In order to discover the extent to which residuals greater than +.75 or less than -.75 affect the answerable variance in growth of the factors, a stepwise correlation program was run including these deviants. Results indicate that 12 variables answered 74 percent of the variation due to growth (Table 3). This would indicate that factors put forward in this period are responsible for most of the normal growth and only 26 percent was left unaccounted for by other variables. Both size of nearest large centre and distance, being of almost equal variance, accounted for 54.7 percent of the growth in Ontario towns and villages while the regional location scored a low 12.7 percent. It is obvious that the urban shadow was drastically affected by deviant centres while economic location was not. This suggests that investigation of the internal economic structure of the residuals in these areas may yield further answers to their unusual growth.

Table 3

Stepwise Summary Table Excluding Residuals (-.75 or +.75)

Variable Entered	Multiple R	RSQ
12	.547	.299
13	.740	.547
3	.796	.634
5	.805	.648
15	.813	.662
7	.821	.674
2	.827	.684
11	.832	.693
10	.836	.700
9	.844	.713
16	.847	.718
14	.860	.740

Residuals

Numerous centres during this decade displayed growth outside the .75 standard error band. Of 72 deviants 34 were underestimated (greater than +.75) and 38 overestimated (less than -.75) (figure 1). Among the overestimated group centres which sustained population decrease were Deloro, Alvinston, Arkona, Thedford, Port McNicoll, Sturgeon Falls, Woodville, Cache Bay and Victoria Harbour. The first 7 recorded a population of less than 1,000 and were also situated at distances between 25 and 30 miles from a major centre. These centres had few services, little or no manufacturing and were often located away from major highways. In Lambton county, Thedford, Arkona and Alvinston were small agricultural villages which had lost prominence as farm centres due to the rapid expansion of Sarnia, a decreasing rural population and improved automobiles and roads (Lauriston, V., 1949). Other villages overpredicted by the regression equation were

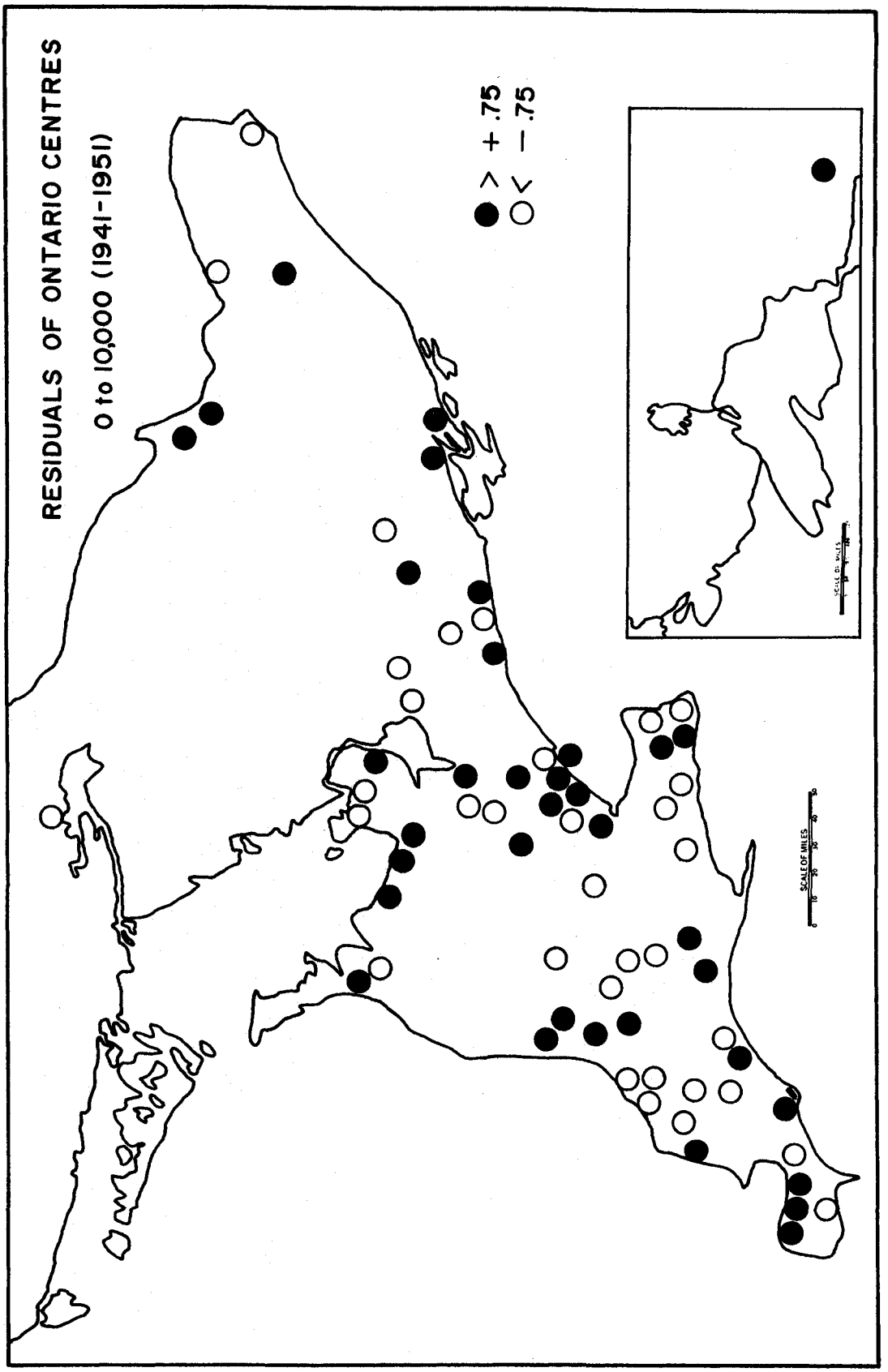

Figure 1

primarily small rural trade centres recording small population gains and were located generally at distances exceeding 15 miles from a major centre (Table 4).

Table 4

Rural Trade Centres (Low Residuals < -.75)

Millbrook	Cayuga	Embro
Dutton	Jarvis	St. Mary's
Kingsville	Bothwell	Milverton
Lancaster	Tilbury	Beeton
Dunnville	Forest	Tottenham

In the 2,500 to 10,000 size class, overpredicted residual towns were: Petrolia, Ingersoll, Preston, Fort Erie, Thorold, Port Hope and Swansea. With the exception of Swansea, all of them relied primarily on manufacturing industries for their economic base. It is difficult, however, to find causes for the slow growth as all were within easy access of large urban centres and did record some growth.

High residuals were divided evenly between those situated within 15 miles of a major centre and those from 15 to 30 miles away. Within the 15 mile radius, 11 of 18 centres, 11/18 acting both as satellite and recreation centres, had less than 1,000 population. Rapid increase in population occurred in such places as Long Branch near Toronto and Waterdown near Hamilton because of city commuting while similar gains have taken place in New Castle near Oshawa and Crystal Beach near Welland, both commuting and recreation centres (Table 5).

Table 5

Urban Fringe Communities (15 mile radius)

Recreation and Satellite Centres	Satellite Centres	Industrial Centres
Crystal Beach	Courtwright	Port Credit

Table 5 continued:

Recreation and Satellite Centres	Satellite Centres	Industrial Centres
Newcastle	Bath	Aylmer
Belle River	Fonthill	Chemsford
St. Clair Beach	Waterdown	Riverside
Erieau	Long Branch	
Hepworth	Woodbridge	
Cobden	Streetsville*	

*22 miles from Toronto

Larger centres located within this radius such as Riverside, Port Credit and Chemsford were industrial extensions of such large cities as Windsor, Toronto and Sudbury.

Residuals in outlying areas situated more than 15 miles from a major centre fell into two categories: manufacturing or rural trade centres (Table 6 and 7).

Table 6

Outlying Manufacturing Centres (15-30 miles) (> +.75)

Tillsonburg	Renfrew
Collingwood	Coburg
Deseronto	Oakville
Orillia	

Table 7

Outlying Rural Trade Centres (15-30 miles) (> +.75)

Stayer	Erin	Exeter
Bradford	Thornbury	Kemptville
Lucan	Seaforth	Norwood
Westlorne	Clinton	

With increasing demand for services after the war, municipalities in higher density agricultural areas grew. Clinton, a small rural village, gained population with the establishment of an RCAF training station during the war. (Scott, J., 1966). Other places located in thriving agricultural districts often became processing and packing centres. Examples

are Bradford, near the vegetable growing Holland Marsh, Westlorne in the tobacco region of Elgin county, Erin in a dairy belt and Exeter and Seaforth in mixed vegetable and cattle areas of Huron county.

The manufacturing centres, usually of a larger size, were located in easily accessible areas with at least three highway routes converging on them. Most of these places had built up their umlands outside the sphere of larger cities (Spelt, 1956).

Comparison of Size Class Means

Comparison of mean growth revealed that an increase in size class resulted in population increase of 5.1 percent and 2.6 percent between the classes. This suggests that village and town population is crudely related to the size of the 1941 population (Hart and Salisbury, 1965). The highest standard deviation of 21.6 in the lowest class of less than 1,000 indicates a greater growth range from -.71 percent to 36.1 percent, further demonstrating unstable and fluctuating growth in smaller places. Standard deviations in the size class 2,500 to 10,000 and 1,000 to 2,500 were 17.4 and 15.8 respectively. Since residuals are the results of unusual growth, then standard deviations could be utilized to predict the size class with the highest or lowest total percent variation due to growth. In this case the highest and lowest results should belong to the size classes 1,000 to 2,500 and 0 to 1,000 respectively.

Greater variation in village population growth is perhaps

an indicator of the two most important factors in this period, distance and size of nearest large centre. In the 0 to 1,000 population size the highest mean distance of 20.4 miles and lowest mean city size of 63,751 were recorded (Table 8) With a standard deviation of 21.6 most villages were located between 12.6 and 28.0 miles from the nearest dominant centre.* The middle and highest size class had lower mean distances and the size of the nearest large city was also larger (Table 8). Distance boundaries for location of centres in the two larger classes were 12.4 to 26.4 and 8.6 to 28.4 miles respectively. The means for distance and nearest large centre should reflect the variation in growth that is accounted for in each class by these factors. Villages in the population range 0 to 1,000 should exhibit the weakest influence of the urban shadow effect. For the larger two class sizes this is difficult to determine because the 1,000 to 2,500 size class had the lowest mean distance and boundary range; its nearest large city was smaller than that of the larger class. Examination of the individual classes should prove the importance of these means in aiding explanation of such variables.

Table 8

Variable	Class Size 0-1,000		Class Size 1,000-2,500		Class Size 2,500-10,000	
	Mean	SD	Mean	SD	Mean	SD
1	14.5	21.6	19.6	15.8	22.2	17.4
12	63,751.0	----	97,517.0	----	136,364	----
13	20.4	7.6	18.4	8.0	18.5	9.9
14	11.2	4.5	7.9	4.7	4.8	3.8
15	37.7	7.5	40.0	11.1	44.9	10.0
16	51.0	7.8	51.1	10.2	49.9	9.2

*In this procedure the standard deviation is added to and subtracted from the mean distance in order to arrive at mean locational boundaries within which most places are found, from the nearest dominant centre.

The growth or decline of population in towns and villages can be influenced by the type of occupational structure. Spelt provides a clear statement on the importance of manufacturing and its effect on town growth.

> In the twentieth century manufacturing became the dominant factor in town growth and often the traditional service function was overshadowed by it. (p207, 1955)

In Ontario the size class of towns and villages was directly related to population growth and the proportion of working force in blue collar and primary occupations. Table 8 reveals that an increase in size class from lowest to highest results in mean increase in blue collar employment, and conversely, a decrease in primary employment. While the difference between the service and blue collar sectors is least in the larger towns, increasing with a decrease in class size from 5.0 percent to 8.9 percent and 13.3 percent respectively, it becomes apparent that blue collar employment is less important in smaller villages which rely more on services for their economic base.

Class Size 0 to 1,000

The Second World War led to an expansion and concentration of manufacturing in Ontario centres (Spelt, 1955). This had favourable consequences on the population growth of villages in close proximity to cities. Only 3 of 14 municipalities which suffered population losses were situated within 20 miles of a large centre and these three centres were found near Owen Sound and Barrie, towns not considered important for manufacturing. When places with growth exceeding 14

percent mean were examined 24 of 29 villages were located within 15 miles of a city.

The correlation matrix shows distance to nearest large centre to have the strongest significant correlation of -.38 at the .025 level. Only two other variables proved to be significant, the Niagara and the St. Clair regions (Table 9). When intercorrelations between the variables were removed by stepwise analysis, distance, St. Clair area, size of nearest large centre, Niagara region, Lake Erie region and Mid-Western region in that order were responsible for 38.2 percent of the variation due to village growth (Table 10). Each of the higher ranking regions contained large and small metropolitan areas and underwent rapid industrial growth during the period (Ontario Department of Economics and Development, 1965, 1965, 1966, 1967). Comparison reveals that urban shadow (distance and nearest large centre) effect accounted for 21.3 percent of the variance in growth, while the total effect of 6 regions accounted for 19.1 percent. The close results indicated the importance of both dimensions in the population growth of Ontario villages.

Table 9

Correlation Matrix

Variable	
2	-.024
3	.237*
4	.012
5	.256*
6	.029
7	-.209
8	.098
9	-.190

Table 9 continued:

Variable	
10	-.139
11	.074
12	.193
13	-.386*
14	-.046
15	.093
16	-.065

*Significant at the .025 level

Table 10

Stepwise Summary Table

Variable Entered	Multiple R	RSQ
13	.386	.149
12	.461	.213
3	.534	.285
5	.570	.325
4	.603	.363
6	.618	.382
8	.628	.394
11	.635	.404
14	.646	.417
15	.647	.419
9	.648	.421

Residuals

Residuals from regression indicated groupings of centres into agricultural, recreational and commuting types. The villages which grew more than was predicted were primarily oriented towards recreation and commuting (figure 2). Municipalities serving both functions were St. Clair Beach, Erieau, Port Rowan, Crystal Beach, Cobden and Creemore, while Courtwright, Streetsville, Norwood and Bath acted as satellites for nearby cities. Eight of these were located within 15 miles of Windsor, Chatham, Sarnia, Welland, Toronto, Peterborough, Kingston, and Pembroke. The remaining two, Port Rowan and Creemore, had become area service centres for recreation sites

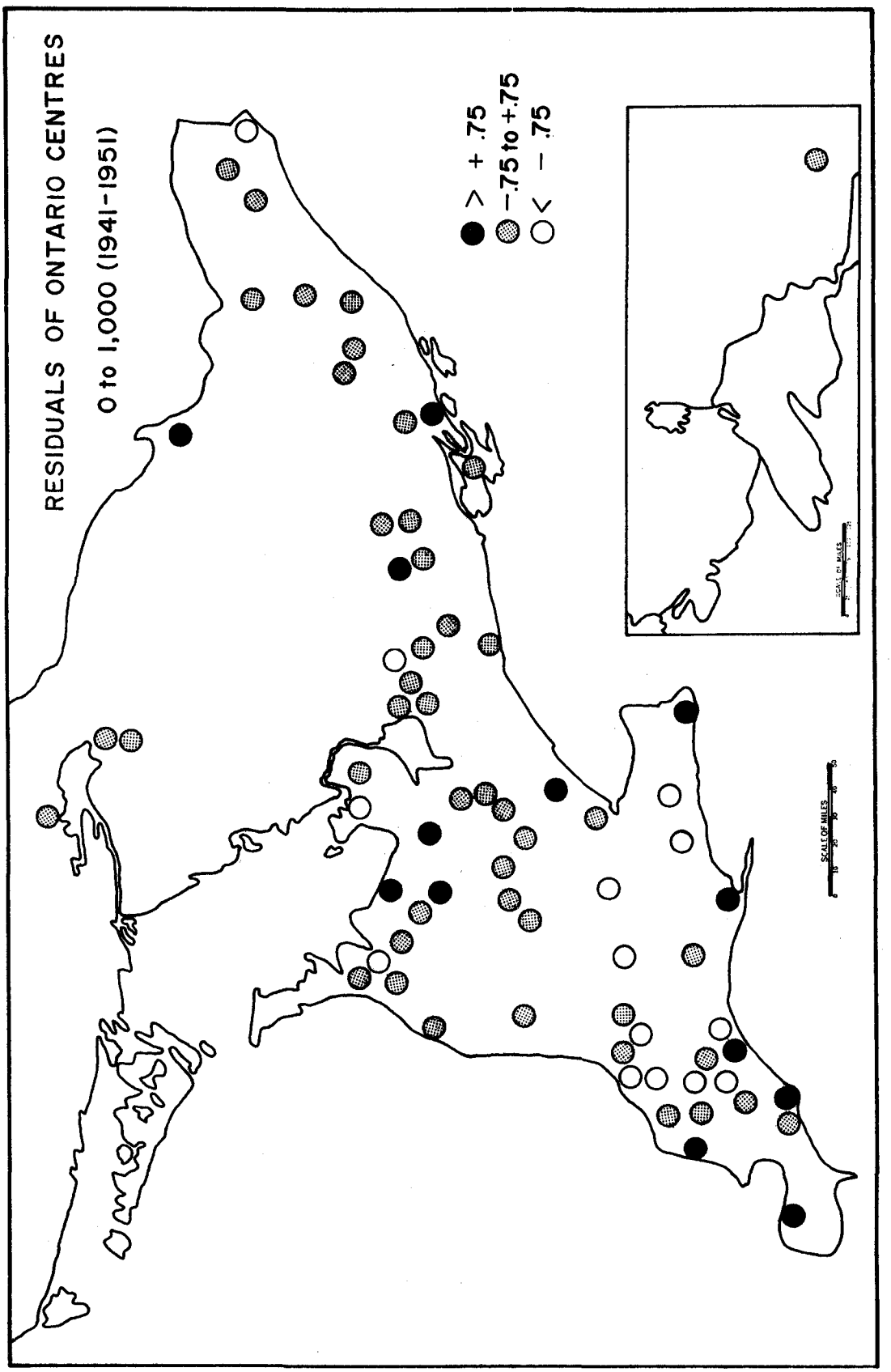

Figure 2

(Ontario Department of Economics and Development, 1965) (Fieguth, 1968).

The final 12 villages were diminishing and stagnating agricultural centres which had been losing population to the larger urban centres since the beginning of the war. (Table 11) Most were located more than 20 miles from a major centre and those in close proximity tended to be near smaller towns such as Owen Sound, Simcoe and Woodstock. Port McNicoll, neither an agricultural nor a recreational centre but rather a shipping port, was suffering from a decrease in grain handling due to the opening of the Welland Canal (Spelt, 1955). Consequently, with less available employment, a population loss of 9.1 percent occurred.

Table 11

Rural Trade Centres

Distance to Major Centre		
20-30 miles		10 -15 miles
Alvinston	Arkona	Shallow Lake
Bothwell	Cayuga	Embro
Thedford	Ailsa Craig	Sturgeon Point
Dutton		Jarvis

Class Size 1,000 - 2,500

Investigation of mean distances revealed that centres in the 1,000 to 2,500 population range had the lowest average of 18.4 miles and smallest locational boundaries of 12.4 to 26.4 miles within which most centres were located. This suggests a more regular pattern of location with respect to larger centres. Figure 3 reveals cluster formations near the larger urban centres of Windsor, Chatham, Sarnia, Kitchener-Waterloo, St. Catherines, Toronto-Ottawa, Belleville-Trenton, Ottawa

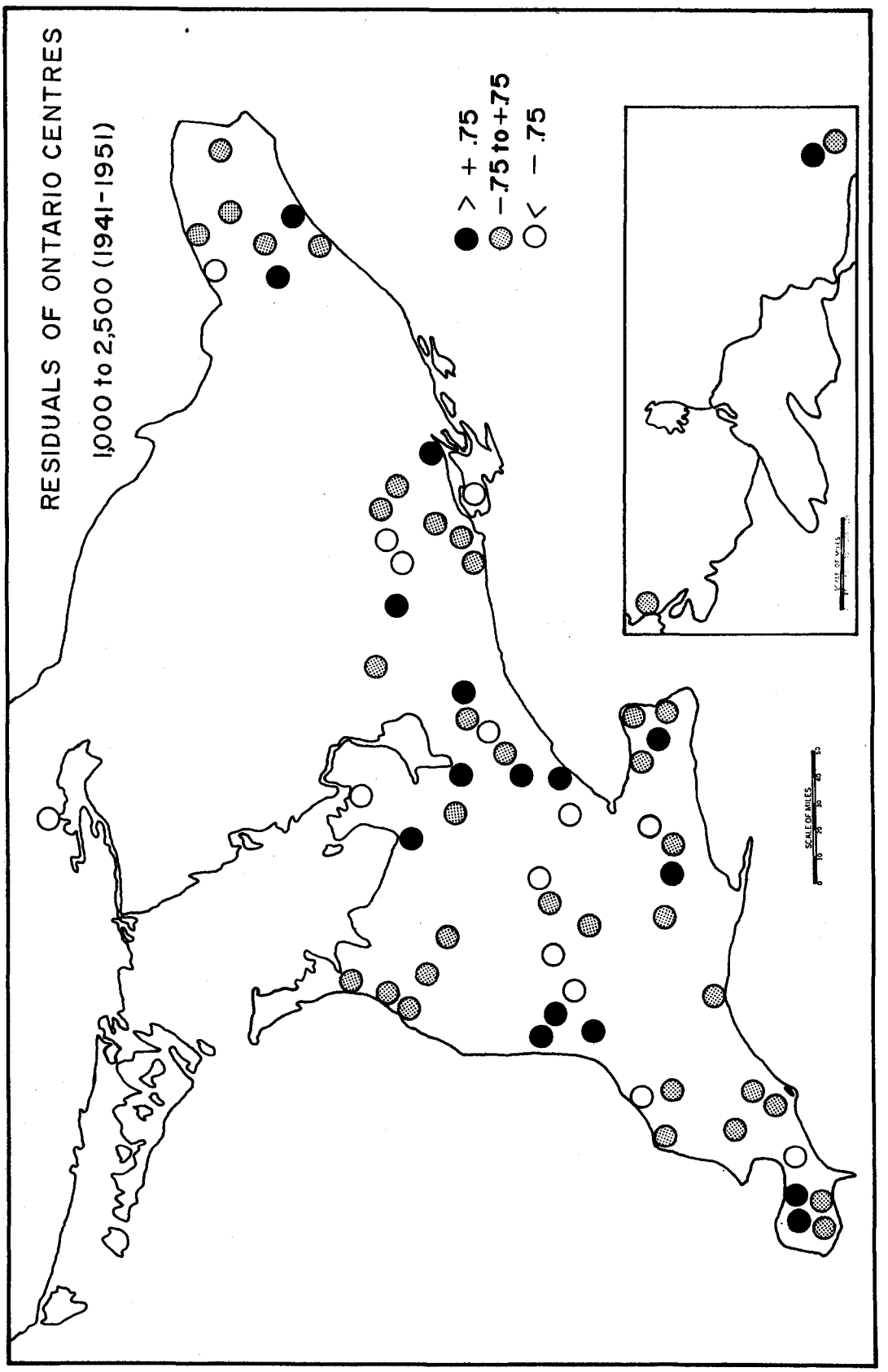

Figure 3

and Sudbury. Such a distribution further suggests that cities perhaps exert a strong influence upon villages and towns of this size class. The correlation matrix supports this conclusion with a strong correlation of .60 between nearest city and population growth of these centres (Table 12). In order, other relationships of significance were the Central Ontario region and distance. The summary table, however, included the Central Ontario economic region when intercorrelations between variables were removed (Table 13). It proved conclusively that the influence of urban shadow dominated as the two functions of distance and size of nearest large centre accounted for a phenomenal 48.7 percent of the variance in growth. Regional effect was of minimal influence responsible for 11.6 percent of the variation, with the Northern Ontario region accounting for 5.6 percent of this growth. Following the war, immigrants moved into this area to fill the labour shortages caused by the expanding mineral industry. Migrational movements of people have been a major factor in the population growth of the Northern area (Ontario Department of Economics and Development, 1966).

Table 12

Correlation Matrix

Variable	
2	.041
3	.108
4	.012
5	.192
6	.005
7	-.201
8	.533*
9	-.168
10	-.222
11	-.240

Table 12 continued:

Variable	
12	.606*
13	-.362*
14	.121
15	-.160
16	-.033

*Significance at the .05 level

Table 13

Stepwise Summary Table

Variable Entered	Multiple R	RSQ
12	.606	.367
13	.698	.487
11	.733	.538
7	.745	.555
10	.759	.576
9	.773	.598
4	.775	.600
6	.776	.603
15	.777	.605
14	.780	.609
16	.786	.618
2	.787	.619

Residuals

High residuals lying more than +.75 standard error above the regression line displayed two locational patterns: Commuting and recreational places in close proximity to large cities (Table 14) and major service centres removed from large urban areas (figure 3).

Table 14

Commuting and Recreation Centres

Essex	Lakefield
Belle River	Port Perry
Waterford	Deseronto
Fonthill	Capreol
Woodbridge	

Some towns and villages found at distances exceeding 20 miles from a major centre grew because of advantageous location in prosperous agricultural areas. In Huron county, the

towns of Clinton, Seaforth and Exeter increased retailing and agricultural processing operations with an increase of 2,430 in rural population. After the war, increased immigration and natural increase resulted in the highest population gains (12.5 percent) of the century for Huron county.

Similar causes were responsible for high growth in the villages of Bradford and Stayer in Simcoe county while the movement of new industry into Kemptville and Morrisburg in Eastern Ontario initiated rapid growth there (MacKenzie, S., 1957; McKenzie, R., 1967).

Few centres less than -.75 standard error below the regression line suffered actual population losses. Examples of centres losing population were: Victoria Harbour, Wellington and Cache Bay. These places, located more than 25 miles from a large city, were in areas with little manufacturing and decreasing rural population (Treasury of Finance and Economics, 1968). Both Cache Bay and Victoria Harbour experienced competition from the nearby manufacturing towns of Sturgeon Falls and Midland respectively. Of the remaining towns and villages, 10 recorded a slow population growth and, of these, Tilbury, Kingsville, Forest, Mitchell, Milverton, Elmira, Caledonia and Havelock displayed a strong agricultural orientation with such small manufacturing operations as furniture making and food processing. The remaining places in close proximity to larger cities, Milton, Stofville and Rockcliff Park, were residential and manufacturing centres. (Milton Centennial Committee, 1957; Walker H., and Walker, O.,

1960) Rockcliff Park was unusual in the sense that it was a suburb of Ottawa, boasting many rich and important government officials, and has consequently had a very restricted growth.

Class Size 2,500-10,000

Distributed along the Great Lakes waterway, 23 towns in the 2,500 to 10,000 population range possessed port facilities (figure 4). Of these, many were located in the rapidly expanding industrial areas of Windsor, St. Catherines-Welland, Hamilton, Toronto and Oshawa while approximately one-half the towns, 24 of 50, were found to be situated at distances of 20 or more miles from a large city. The standard deviation of mean distance proved that these towns were situated in the greatest distance ranges (8.6 to 28.4 miles from the nearest large centre). This dichotomy between places in close proximity and those at peripheral distances indicates the importance of both large urban centres and regional location on the population growth of towns.

Findings of the correlation matrix and summary table confirm that urban shadow and regional location are instrumental in growth. The size of nearest large city and the Central Ontario area were the only significant correlations (Table 15). In the summary table, six factors answered 46 percent of the variation due to growth (Table 16). Ranking first and accounting for 23.4 percent of the variation in growth, the dominant factor proved to be size of the nearest large centre. Comparison of urban shadow and regional effect

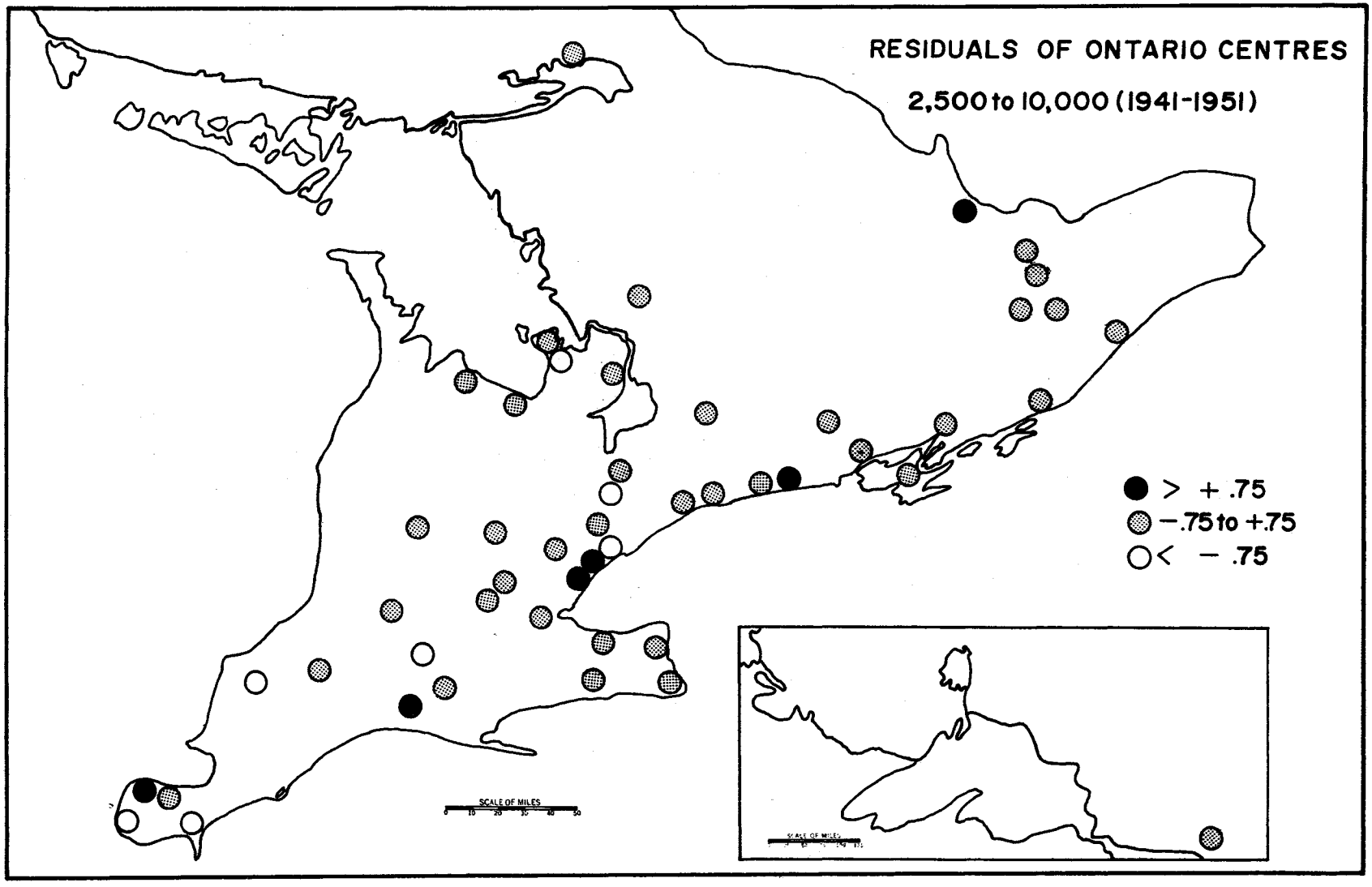

Figure 4

reveals each to be responsible for 24.9 percent and 18.6 percent of the growth respectively. Although the urban effect ranks highest, the regional influence cannot be discounted. The wide range of locations of these places suggests many to be outside urban dominance and thus to be relying for their population growth on such regional factors as accessibility, new or expanding industry or even port facilities.

Table 15

Correlation Matrix

Variable	
2	-.004
3	.337
4	.086
5	-.064
6	-.127
7	-.136
8	.394*
9	-.171
10	-.228
11	-.176
12	.484*
13	-.272
14	-.156
15	.044
16	.008

*Significance at the .025 level

Table 16

Summary Table

Variable Entered	Multiple R	RSQ
12	.484	.234
3	.611	.374
4	.643	.413
14	.663	.440
13	.675	.455
2	.679	.461
15	.681	.464
16	.685	.469
10	.687	.472

Residuals

Displaying unusually high or low population growth,

residual centres were distributed primarily along the Great Lakes. Four of these towns, Coburg, Long Branch, Oakville and Riverside, grew more than was predicted and three centres, Leamington, Amherstburg and Midland, grew less than was predicted by the regression equation. All of the above places had port facilities which they relied on for trade purposes. The decline or stagnation of ports when a loss of trade occurs has been well demonstrated by Spelt (1955). Only one centre, Renfrew, not located on the Great Lakes, registered a substantial growth mainly due to an increase in retailing and small-scale manufacturing establishments.

Petrolia, Ingersoll, Swansea and Aurora, with population gains of 10.8 percent, 12.8 percent, 15.5 percent and 23.1 percent, were below the predicted rate for which the population ought to have changed for towns of their individual sizes in 1941. In the first three places small population gains were attributed to a slower manufacturing growth, while in the fourth town a locational problem was prominent (Lauriston, 1949; Spelt, 1955; Murdie, 1969). Aurora, situated 18 miles from Toronto, was competing with Richmond Hill and Thornhill, both in closer proximity to Toronto and along the same route. This is well substantiated by the 60.8 percent population increase which took place in Richmond Hill during the 1941-1951 period.

Comparison of Three Size Classes

The highest total variance in growth was in the second size class which recorded the lowest standard deviation. An increase in standard deviation in the class size 2,500 to

10,000 and 0 to 1,000 respectively, resulted in lower variance results. The variables accounting for most of this variance in growth during the 1941-1951 period were size of nearest large centre and distance, the former ranking first when all Ontario towns and villages were investigated as well as in the two large size classes 1,000 to 2,500 and 2,500 to 10,000. Distance, which ranked second when all centres were examined, proved to be first in the smallest size class. The importance of distance was implied by the means which revealed the 0 to 1,000 size class to have the farthest distance distribution ranges from the smallest average size city. Conversely, each of the two larger size classes of towns and villages had closer distance ranges and larger average size cities. In both, the size of nearest large centre ranked first while distance registered second in the 1,000 to 2,500 class and fifth in the 2,500 to 1,000 group. It would appear that an examination of means is warranted since it reflects and aids explanation of these two variables.

The high rankings and component results show urban shadow to be the dominant dimension of population growth in this period. A concentration of manufacturing in larger cities during the war was a fundamental cause of this dominance. Investigation of all Ontario centres revealed that urban shadow accounted for 28.5 percent and regional location for 10.0 percent of the variation in growth. In the second size class this was even more marked with a 37.6 percent difference between urban shadow and regional location. Centres in this class were found to be in closer proximity to nearest large

city with many acting as satellite and recreation communities. In both the largest and smallest size classes the two dimensions showed respective differences of 6.3 and 2.2 percent in favour of urban shadow. Because the largest size group relied more heavily on an economic base of manufacturing which may have extra-regional or even international markets, it was perhaps possible to achieve greater autonomy from city influence. Many towns located in the Great Lakes region depended on port functions for growth. Moreover, investigation uncovered the fact that towns were located over a great range of distances from the nearest large city. The centres at peripheral distances, in order to maintain a growth comparable to that of towns in closer proximity, would rely more on regional growth factors for their growth. Small villages distributed at greater distances from nearest large centre than the two larger size classes provided further proof of the weakening urban shadow effect. This wide scattering of places resulted in a minimal variance difference between urban and regional components, suggesting that centres in periphery distances are, to a greater extent, subject to general economic conditions affecting the region.

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Chapter III

Population Changes During The Period 1951-1961

A population gain of 1.6 million in Ontario during the 1951-1961 period proved to be the highest since the beginning of the century. Factors primarily responsible for this gain were a high natural increase rate and migration (Stone, 1968). Primed by U.S. sources, manufacturing continued its post-war expansion and decentralization, thus stimulating population growth on account of in-migration.

> There has been a trend towards the dispersion of manufacturing industry from highly industrialized counties to rural counties in Ontario. Furthermore, the results support the hypothesis that the strongest locational trends are of diffusion of manufacturing activity from the major city centres to surrounding metropolitan areas and satellite towns. (Hay, K.A., p381, 1960)

Consequently, with a rapid economic growth, most Ontario centres recorded increase at a time when only 11 of 180 towns and villages lost population, the result being a high mean growth of 20 percent in the ten year span.

When the 16 variables were correlated with the percent growth of centres, significant readings were discovered for the Central Ontario region, Niagara region, Northern district, and the negatively correlated distance (Table 17). The negative distance implied that municipalities located within

close proximity to a dominant centre had greater population accretion than those located at farther distances within the 30 mile radius. The growth of centres in the Central Ontario and Niagara regions is understandable since they include Toronto and Hamilton, two of the largest metropolitan areas in Ontario. These metropolitan areas experienced a rapid growth of towns and villages due to the importance of commuting and industrial gains (Spelt, 1956; Murdie, 1969). In the Northern district a rapid increase in mining, a primary activity, resulted in greater employment and consequently the population of this area increased with the demand for labour (Ontario Department of Economics and Development, 1965).

To clarify the importance of these different variables, the summary table provides a list of factors in order of importance. Fifteen variables were found to answer 29 percent of the variation in growth (Table 18). The first six, in order of importance, distance, Central Ontario region, size of nearest large centre, Georgian Bay area, Niagara region and St. Clair area, were responsible for 26 percent of the variation in growth. The inclusion of the Georgian Bay region, which had experienced out-migrations of people and little industrial gain, was unexpected (Pearson, N., 1968). Simcoe county, however, grew rapidly between 1951 and 1961 due to a growing recreation industry and the movement of industry into Barrie, Orillia, Collingwood and Midland, (Fieguth, 1968). The demand for services by tourists resulted in growth

of many small villages and towns near Georgian Bay. In the St. Clair economic division, a growing automobile industry in Essex county and the expansion of petrochemical manufacturing in Lambton county caused increased growth in surrounding municipalities (Ransome, J., 1968).

When comparison of the components was made, the regional factors accounted for 14.4 percent and urban shadow for 13.0 percent of the growth. Rapid economic growth coupled with a trend towards industrial decentralization and plant expansion in small municipalities affected the growth of towns and villages, resulting in a stronger regional influence. An examination of class sizes should prove whether similar differences exist between these two components.

Table 17

Correlation Matrix 1951-1961

Variable		
2	Size of Place	.118
3	St. Clair Region	.120
4	Lake Erie Region	-.027
5	Niagara Region	.204*
6	Midwestern Region	-.034
7	Georgian Bay Region	-.071
8	Central Ontario Region	.240*
9	Eastern Ontario Region	.003
10	Lake Ontario Region	-.024
11	Northern Ontario Region	.200*
12	Population of nearest large centre	.144
13	Distance to nearest large centre	-.318
14	Percent employed in primary sector	-.024
15	Percent employed in blue collar sector	.062
16	Percent employed in service sector	-.026

*Significance at the .05 level

Table 18

Stepwise Summary Table 1951-1961

Variable Entered	Multiple R	RSQ
13	.318	.101
8	.439	.193
12	.482	.232
7	.500	.250
5	.511	.261
3	.516	.266
9	.521	.271
10	.525	.276
6	.529	.280
11	.534	.285
14	.537	.289
2	.540	.292

Residuals

In this period 52 residuals were listed with 25 less than -.75 S.D. and 26 more than +.75 S.D. (figure 5). When these residuals were excluded from the stepwise correlation program, the total variation in growth caused by 15 variables rose to 54 percent, almost double the previous results. Only a slight reorientation of variable rankings occurred (Table 19). The distance remained stable (at the same percent and rank) but the Central Ontario region dropped in importance being replaced by the Niagara region. A map examination shows a large concentration of 17 deviants in the Central Ontario district (figure 5). Ten of these are within a 35 mile radius of Toronto, considered to be the commutershed zone for this area (Design for Development: The Toronto Centred Region, 1970). The rapid expansion of Toronto in the decade 1951-1961 resulted in increased growth of suburbs and surrounding towns (Bourne, 1967; Murdie, 1969) Centres

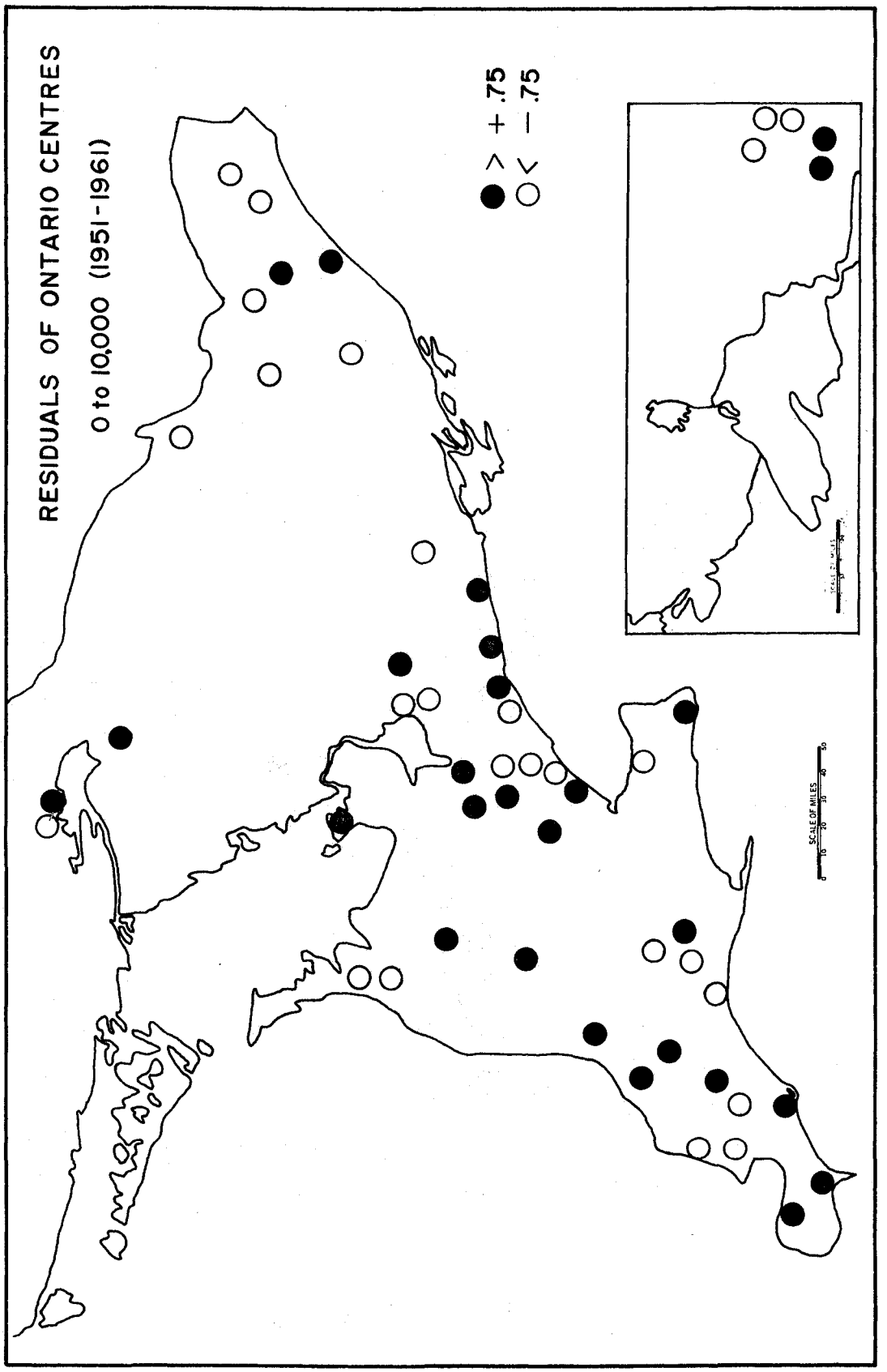

Figure 5

in which manufacturing was predominant such as Port Credit, Acton and Whitby were residuals recording population gains exceeding 43 percent, while centres primarily of a commuting nature, such as Ajax, Weston and Woodbridge, were low residuals, although each had population increases exceeding 13 percent.

Table 19

Stepwise Summary Table
(Excluding Residuals < -.75 and > +.75)

Variable Entered	Multiple R	RSQ
5	.462	.181
13	.533	.284
12	.616	.379
8	.664	.442
14	.683	.466
7	.700	.490
11	.710	.505
6	.720	.519
4	.726	.528
3	.730	.533
16	.731	.535
2	.733	.538
15	.735	.540
9	.736	.542
10	.736	.542

Residual centres were grouped into several economic categories, agricultural, recreational-agricultural, commuting and manufacturing. As in the previous decade, low residual agricultural type were generally small villages located more than 15 miles from a major city (Table 20).

Table 20

Agricultural Centres (Low Residuals)

Hepworth	Cobden
Springfield	Tottenham
Maxville	Finch
Thamesville	New Liskeard

Their locations were often in regions relatively slow agricultural development, examples being Hepworth in Bruce county (Robertson, N., 1960), New Liskeard in Northern Ontario or Cobden in Renfrew area. Conversely, high residual agricultural centres (Table 21) were often located in flourishing farming areas, as Bradford near the rich vegetable producing Holland Marsh (Mackenzie, 1957) or Exeter, serving a rich agricultural industry which surrounds it (Scott, 1966). Moreover, the expansion of existing processing plants in some of these centres often stimulated growth.

Table 21

Agricultural Centres (high residuals)

Durham	Bolton
Exeter	Bradford
Arkona	Chemsford
Newbury	

Communities serving as both recreational and service centres were distinctly grouped between those recording high growth near larger cities and those at greater distances with slower growth (Table 22). The high residuals acted not only as recreation centres but often as urban fringe communities of larger cities such as St. Clair near Windsor (Ransome, 1968) or New Castle near Oshawa.

Table 22

Recreation-Service Centres

High Residuals		Low Residuals	
St. Clair Beach	Sturgeon Point	Port Stanley	Beaverton
Erie Beach	Trout Creek	Newboro	Cannington
Crystal Beach	Newcastle	Cache Bay	Milverton
		Hastings	

The commuting centres were located primarily near large metropolitan cities. Those underestimated by the regression were few, such as Capreol near Sudbury and Richmond near Ottawa, since most were overestimated (Table 23). It is difficult to find causes for the slower growth of the low residuals. Perhaps the fact that little manufacturing was present may have caused a slower population growth. Certainly, the greatest number of deviants exhibiting unusually high growth were manufacturing towns (Table 24).

Table 23

Commuting Centres

High Residuals	Low Residuals	
Capreol	Courtwright	Weston
Richmond	Beamsville	Swansea
	Ajax	

Table 24

Manufacturing Centres

High Residuals		Low Residuals
Leamington	Tillsonburg	Wallaceburg
Prescott	Port Credit	Carleton Place
Kemptville	Listowel	Ingersoll
Strathroy	Sturgeon Falls	
Coburg	Pentaguishene	
Whitby		

These places were generally in the largest class size, as shown in the investigation of mean occupations. Decentralization and expansion of industry generally benefited the high residual towns. On the other hand, more than half of these centres, including Port Credit, Coburg, Whitby, Prescott, Pentaguishene and Leamington, had port facilities which further enhanced their position as growth points. For example,

Port Credit imports petroleum for its oil refineries, (Spelt, 1955) and Prescott is important for its grain elevators (Morris, J.A., 1969). Only three overestimated towns were present and, in each, slower industrial growth took place. Wallaceburg and Ingersoll were located near the small manufacturing cities of Chatham and Woodstock respectively. Conversely, Caleton Place is situated 28 miles from a large metropolitan area, Ottawa, which is primarily known for its public service (Putnam, D.F.; Putnam, R.G., 1970).

Comparison of Size Class Means

A close equalization of mean population growth among the three size classes was witnessed in this decade. Table 25 indicates that the third size class, 2,500 to 10,000, revealed the greatest mean growth of 22.6 percent, succeeded by both the second and first size categories with 21.9 and 17.6 percent respectively. The highest population gains of the century in these classes among Ontario towns and villages suggests the strong influence of the rapid economic expansion. Areal population growth in Western countries is generally associated with economic stability (Kariel, H.G., 1963; Porter, R., 1956; Webb, J.W., 1963). Attesting to this relationship on a regional level, Putnam, D.F. and Putnam, R.G., in an analysis of Ontario, have stated:

> Quite obviously, population growth is the best indicator of economic activity in the present and the immediate past. (p244, 1970)

In effect, the decade 1951-1961 witnessed the highest economic

growth of the century which was also reflected in the greatest population gain. According to the budget statement of the Minister of Finance, Leslie M. Frost in the Legislative assembly:

> This was a time of unparalleled expansion that carried capital investment, production, employment and living standards to historically high levels. (p5, 1958)

When the standard deviations of growth were examined, the smallest and largest size classes had identical variations of 22.6 percent while the middle class had a standard deviation of 17.6 percent. The lower deviation indicates population increase with less extreme fluctuations and greater stability, therefore signifying the highest percent variance results to be in this size group. In the largest and smallest size categories, identical standard deviations should produce similar variance results. The higher deviations were the result of greater population losses in small villages of the 0 to 1,000 size category and, conversely, extreme population gains, as high as 95 percent, in the larger towns of the 2,500 to 10,000 size class. As size group increased from the lowest to the highest a decrease in the number of centres losing population from 12.3 percent to 3.2 percent and 1 percent occurred. Studies of small places support the concept that smaller size places tend to have more centres with population losses (Nelson and Jacobson, 1941; Radcliff, 1944; Brunner, 1951, 1952; Hassinger, 1957; Northam, 1963). While the degree of unstable growth increases with a decrease in the size of Ontario towns and villages, an

increase in size results in a more stable population growth.

Few authors, however, delve into the causes for the greater incidence of population decline in smaller centres. An examination of mean distances from a major centre within each size group should aid explanation of this occurrence. Table 25 shows that greatest mean distance, 22.9 miles, was in the smallest size class while the standard deviation indicates that most villages fall within ranges of 12 to 32 miles of a major centre. In the second and third classes lower mean distances of 18.7 and 20.4 miles, with standard deviations of 8.6 and 11.8 occurred, respectively. Distance ranges of 10.1 to 27.5 miles for the 1,000 to 2,500 population range and 8.6 to 32.2 miles for the 2,500 to 10,000 size class suggest that municipalities falling in these classes are in closer proximity to dominating centres. Since it has been demonstrated that distance is an influential factor in growth, the large number of small centres located at farther distances partially explains the great number of these places losing population.

As discovered in the previous decade, the employment structure indicates a mean decrease in primary and blue collar occupations from highest to lowest size class (Table 25). In the service sector a 1.7 percent difference existed between the highest mean in the 1,000 to 2,500 class and the lowest in the 0 to 1,000 population range, while the difference was only .2 percent in the previous decade. This suggests the growing importance of services in smaller places

as compared to the prominence of manufacturing in larger towns.

Table 25

Variable	Class Size 0-1,000		Class Size 1,000-2,500		Class Size 2,500-10,000	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1	17.6	22.6	21.9	17.6	22.6	20.8
13	22.9	10.6	18.7	8.6	20.4	11.8
14	9.5	8.9	6.6	5.9	3.2	2.3
15	36.0	7.3	36.8	10.0	39.4	8.0
16	55.1	8.8	56.7	10.0	56.0	10.6

Size Class 0-1,000

The correlation matrix reveals two variables to be significant, the St. Clair region and Distance (Table 28). Both occupied the first two ranks among 10 variables which were responsible for 31 percent of the variation in growth when intercorrelations between variables were removed (Table 29). The initial 6 accounted for 27 percent of this growth. Among these the regions of St. Clair, Central Ontario and Georgian Bay contributed most with 16.6 of the total variance while distance and size of the nearest large centre (urban shadow) accounted for 10.0 percent. The Lake St. Clair and Central Ontario regions, containing the large metropolitan areas of Windsor and Toronto, experienced a rapid growth and expansion of industry. This had some favourable consequences on surrounding small centres, many of which benefited from increased population. Rural centres such as Arkona and Wyoming expanded existing agricultural processing plants to meet the demand for foodstuffs (Lauriston, 1952) while other small centres such as St. Clair Beach and Bolton gained some of the city commuting populations. The third region, Georgian Bay,

normally considered to be an area of slower growth (Putnam and Putnam, 1970), was able to achieve a higher standing due to the growth of the recreation industry. Visitors from the nearby Toronto area increased the demand for recreational services in many small villages throughout the area (Fieguth, 1968).

Table 28

Correlation Matrix

Variable	
2	.073
3	.276*
4	.019
5	.181
6	.079
7	.028
8	.173
9	.120
10	.096
11	.065
12	.133
13	-.272*
14	-.138
15	.179
16	.019

*Significant at the .025 level

Table 29

Summary Table

Variable Entered	Multiple R	RSQ
3	.275	.076
13	.354	.125
12	.420	.177
8	.484	.234
7	.516	.267
14	.542	.294
11	.546	.298
10	.552	.305
6	.556	.309
9	.557	.311

Residuals

Investigation of residuals reveals a scattered pattern

with nineteen centres underestimated and nine overestimated by the regression equation (figure 6). The greatest number of high growth villages were recreationally-oriented and were within close reach of cities such as Chatham, Lindsay-Peterborough, North Bay and Toronto (Table 30).

Table 30

Recreation Oriented Centres

High Residuals (>+.75)		Low Residuals (>-.75)
Erie Beach	Bonfield	Erieau
Tiverton	Coldwater	Westport
Millibrook	Greemore	Cannington
Sturgeon Point	Powassan	Newcastle
Trout Creek		

The high ranking of the Georgian Bay region, undergoing a rapid expansion of the recreation industry, is well borne out as 6 of 9 underestimated centres were located here.

Low residual recreation centres revealed diverse causes for growth. Westport, a summer resort centre noted for its excellent fishing (McKenzie, 1967), was beset by several disadvantages such as a considerable distance from Kingston, the nearest large city, poor road accessibility and competition from Newboro, also a tourist centre (Centennial Committee of Newboro, 1967). Competition from nearby recreation centres seems to have been a cause of less than predicted population gains in the remaining places. Examples of such cases are: several miles from Erieau, a relatively slow growth centre, was Erie Beach, a high growth centre; Cannington was adversely affected by competition from Georgian Bay and the Lake Scugog areas; Newcastle on Lake Ontario experienced rivalry from larger towns such as Bowmanville and Port Hope with

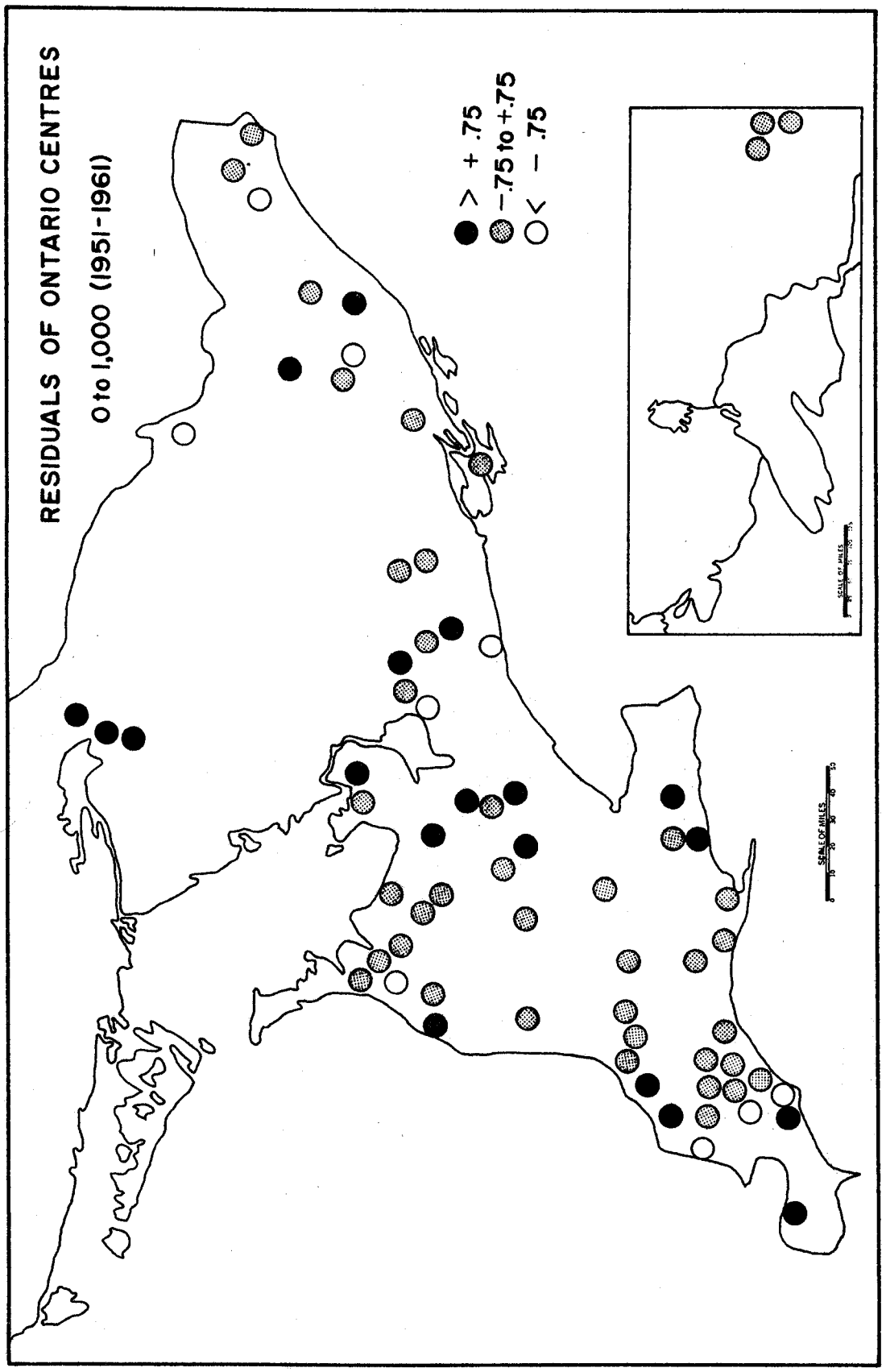

Figure 6

their own resort beaches.

The rapid growth of satellite centres over considerable period of time has left few incorporated places in the 0 to 1,000 size group. Most villages in this category, such as Streetsville, Waterdown, Richmond and Bath, during the period 1941-1951, moved into the next size class. This left only St. Clair Beach near Windsor and two relatively new dormitory towns, Wyoming near Sarnia and Cayuga close to Hamilton, with rapid population gains.

Final groupings of villages was into two rural service types (Table 31). Those which grew quickly due to advantageous locations or expanding agricultural processing plants, as in the case of Arkona, Erin and Athens (Lauriston, 1952), (Dryden and Smith, 1962), (Chant, E.B., 1967) and those which grew slowly because of disadvantageous locations away from major centres, or possessed few agricultural firms.

Table 31

Rural Centres

High Residuals (>+.75)		Low Residuals (<-.75)
Arkona	Beeton	Thamesville
Erin	Athens	Finch
Jarvis	Lanark	Cobden

Size Class 1,000 to 2,500

The clustering of centres near large cities as occurred in the previous period appeared in this decade (figure 7). Investigation of mean distances and standard deviations demonstrated that within a 30 mile radius of a large centre the 1,000 to 2,500 size class had the closest distance range.

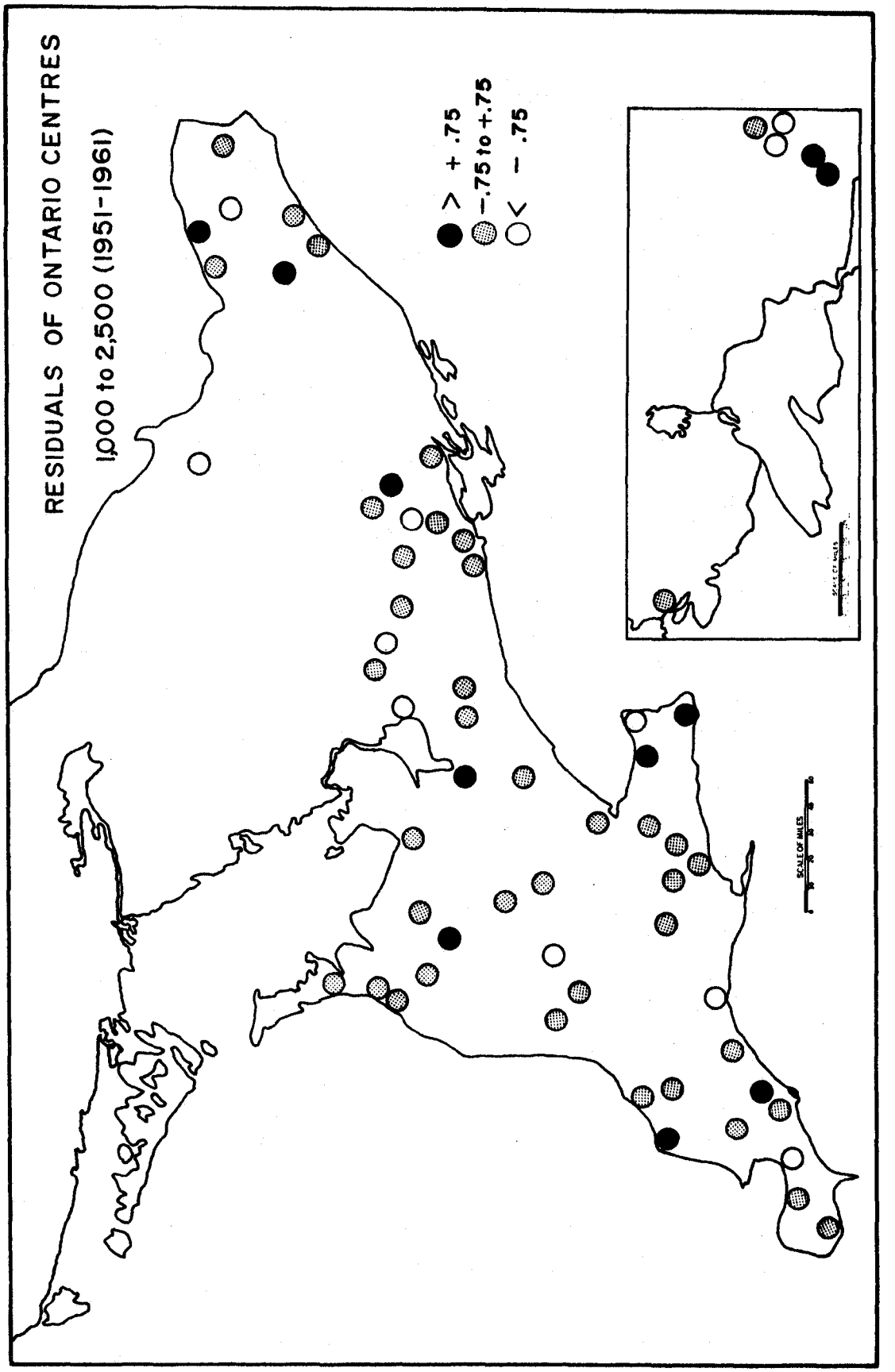

Figure 7

This locational distribution signifies the presence of satellite centres serving as commuter's nodes to larger cities (Table 32) and, as in the previous period, this perhaps is an indication of the urban shadow dominance. The correlation matrix, however, revealed strong regional effect with significant correlations for the Northern region, primary occupations, Niagara region, distance to nearest large centre and the Central Ontario region (Table 33).

The cluster distribution of centres does appear to reflect the urban shadow but economic growth as a factor responsible for stimulating a total regional growth of centres dominates. Moreover, the unusually high growth of six satellite centres placed them among the high residuals; therefore, their contribution to the urban shadow effect was excluded.

A large influx of people due to increased demand for labour in expanding mining industry explains the high ranking of the Northern area and primary occupations (Ontario Department of Economics and Development, 1966). In the centres of Marmora, Mador, Havelock and Lakefield of the Lake Ontario region, an increase in mining also took place (Boyce, 1967). The remaining three regions of Niagara, Lake Erie and Eastern Ontario each displayed a similar 3 percent

*The six centres were residuals exceeding one standard error; therefore, their growth is explained by other factors than those postulated. These places are thus not affected by distance to or size of nearest large centre (urban shadow).

variance growth but for different reasons. In the first two economic areas a rapid growth in manufacturing was experienced while in Eastern Ontario manufacturing as well as administrative growth took place. Increases in public service employment in Ottawa caused not only sharp population gains but also the movement of more people into surrounding centres (Walker and Walker, 1960). The growth of manufacturing in Eastern Ontario took place along the "St. Lawrence Front" in the cities of Kingston Brockville and Cornwall (Putnam and Putnam, 1970). In turn, small towns such as Cardinal and Kemptville benefited by receiving some of these new industries (McKenzie, 1967).

Table 32

Commuting Centres

Point Edward*	Uxbridge	Rockcliff Park
Belle River	Beamsville*	Capreol*
Elora	Crystal Beach*	Chemsford*
Woodbridge	Rockland*	

*Residual centres (>+.75)

Table 33

Correlation Matrix

Variable	
2	-.015
3	.164
4	.073
5	.370*
6	-.054
7	-.012
8	.327*
9	.117
10	-.022
11	.376*
12	.197
13	-.343*
14	.372*

Table 33 continued

Variable	
15	-.043
16	-.156

*Significant at the .025 level

Table 34

Summary Table

Variable Entered	Multiple R	RSQ
11	.376	.141
14	.489	.239
13	.576	.332
12	.645	.417
5	.670	.449
4	.692	.479
9	.715	.512
6	.728	.530
8	.741	.550
10	.745	.555
2	.750	.562
3	.752	.565
7	.752	.567
16	.755	.570

Residuals

Centres of the 1,000 to 2,500 size class showed different residual groupings than in the 0 to 1,000 size class which revealed a predominance of agricultural and recreational types. A change towards greater diversification of functions, even among the agricultural centres, characterizes this size class. The rural municipalities of Ridgetown, Bradford and Chemsford had high population growth not only because they commanded good agricultural umlands but also because of agricultural processing firms. An example is Bradford, the business centre for a large and prosperous farming area which also serves as a processing centre for the rich Holland marsh. An increase in the number of new

companies during the 1950's caused rapid population gains throughout the area (Makenzie, 1957).

Other centres of rapid population gain, Point Edward, Crystal Beach, Beamsville, Capreol and Rockland, were commuting satellites of large cities. Even in these communities some diversification of functions was present in the form of manufacturing and commercial at Point Edward and Beamsville and recreation at Crystal Beach.

The communities of Durham, Tweed, Kemptville and Milverton were grouped as diversified communities since each dealt with a variety of functions such as services, manufacturing industries like wood, textiles, chemicals, agricultural processing and tourism. Except for Milverton, all others were located in areas of growing manufacturing: Durham in a region that is important for furniture production (Thoman, R.S., and Yeates, M.H., 1966); Tweed in an area experiencing mining expansion and rapid lakeshore industrialization (Boyce, 1967); and Kemptville near the St. Lawrence river which, in the post-war years, gained many new industries (McKenzie, 1967). Only Milverton, situated near Stratford, suffered a slower population gain due to the phasing out of the Canadian National locomotive repair shops in Stratford which, at one time, employed several hundred men (Johnston, W.S., and Johnston H.M., 1967).

Grouped in recreation, mining and administrative categories were the remaining low residual centres: Haileybury, the administrative centre for its district, had a 16.7

percent population gain and, except for its northern location and lack of industry, it is difficult to determine other causes of slow growth. Conversely, Cobalt, a silver mining town, experienced slower growth as a result of a declining demand for silver and the depletion of certain silver producing properties (Ontario Department of Economics and Development, 1966). Recreation centres at Port Stanley, Beaverton, Bobcaygeon and Eganville, located near the smaller cities of St. Thomas, Lindsay and Pembroke, also grew at slow rates. Often, competition was provided by close-by recreation centres such as Sturgeon Falls near Lindsay or Golden Lake near Pembroke. Port Stanley, which also relied on its shipping functions, was not able to attract effectively new industries or expand port facilities enough to maintain additional population.

Size Class 2,500 to 10,000

Distribution of towns in the 2,500 to 10,000 size class was primarily along the Great Lakes waterway, with 15 of these places containing port facilities. The towns of the Lake Ontario region had 5 of 7 centres situated on Lake Ontario. Three of these, Port Credit, Whitby and Oakville, containing large port facilities, each had population growth exceeding 44 percent. An examination of the correlation matrix shows this region to have the strongest correlation with percent population change and only one other variable, distance, being significant (Table 35).

The summary table reveals that the Central Ontario region

and distance accounted for 17 percent and 11 percent of the total 34 percent variance due to growth (Table 36). The size of the nearest large centre was of little importance in the growth of Ontario towns, indicating that perhaps these places have more locational autonomy. However, this was not true as the mean distance ranges have shown that towns were situated in both close and periphery radii of large centres. On the other hand, this may indicate a functional rather than locational autonomy since many of these towns carry on manufacturing for extra-regional markets. A strong regional growth which accounted for 20.5 percent as compared to 12.5 percent for the urban shadow suggests that the rapid economic growth as reflected by the industrial gains in most towns was a primary causative.

Table 35

Correlation Matrix

Variable	
2	.098
3	.072
4	.178
5	.212
6	.157
7	.117
8	.415*
9	.015
10	.095
11	.125
12	.306
13	-.344*
14	-.024
15	-.014
16	.078

*Significant at the .025 level

Table 36

Stepwise Summary Table

Variable Entered	Multiple R	RSQ
8	.414	.172
13	.537	.289
7	.545	.297
5	.555	.309
14	.562	.316
12	.570	.325
6	.577	.333
15	.581	.338
10	.583	.339
4	.585	.342
16	.586	.344
9	.587	.345
2	.588	.346
3	.589	.347
11	.590	.348

Residuals

Residuals high and low deviants had a variety of locations irrespective of distance from major cities. Figure 8 shows high residuals along Lake Ontario at Coburg, Whitby, and PortCredit and on Lake Erie at Leamington. Each centre had an advantage for growth because it retained both port and manufacturing functions. During this decade of rapid economic growth, towns with ports became the gateways for incoming and outgoing goods not only for themselves but also for other villages, towns and cities. Of 15 ports, 8 or 53 percent displayed increases above the mean percentage of 22 whereas inland towns had 10 of 30 or 33 percent with growth above the mean.

Two high residual inland towns, Strathroy and Sturgeon Falls, had both gained new light manufacturing firms concerned with furniture, wood products, abrasives and glass.

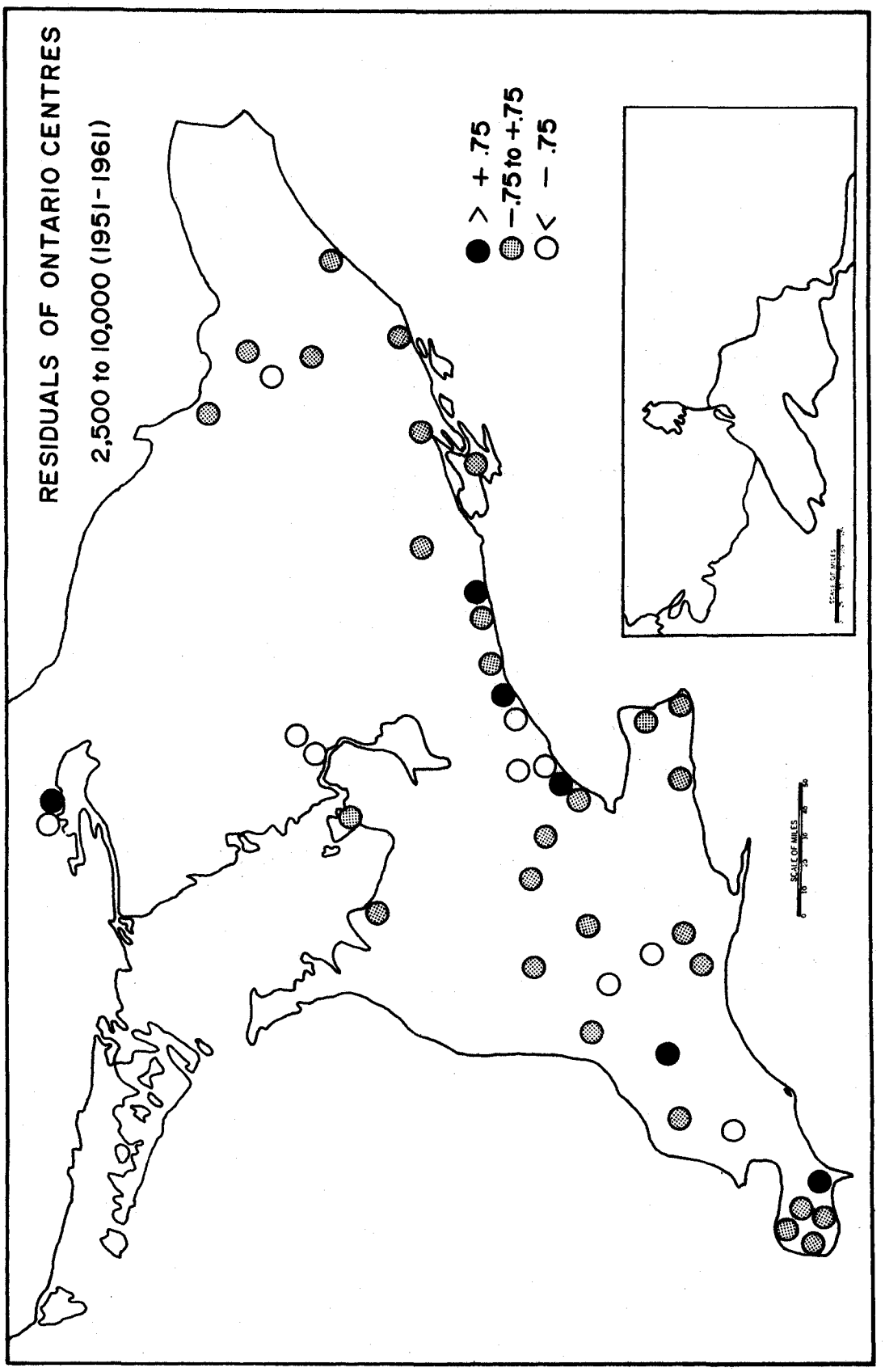

Figure 8

Strathroy was also a business centre for the surrounding agricultural district (Mitchell, P., 1960).

Receiving few new manufacturing firms, Wallaceburg, Ingersoll, St. Mary's, Carleton Place and Cache Bay were generally low residual towns. Some low residual towns such as Cache Bay, Carleton Place and Ingersoll experienced competition from nearby towns of comparable or larger size, including Sturgeon Falls, Smith Falls and Tillsonburg. In the case of Bracebridge, a recreation and light manufacturing town, similar competition from centres further south in Simcoe county, which were more accessible to the Toronto area, affected its growth (Spelt, 1955).

The remaining low residuals of Ajax, Swansea and Weston situated near Toronto were towns of low degree of industrialization with some emphasis on commuting. Ajax, after the war, was developed as a satellite town of Toronto and Oshawa (Spelt, 1955). It is possible that the predominately satellite nature of these towns hindered their ability to maintain a growth rate comparable to the towns that offered both industrial employment and commuting possibilities within this area.

Comparison of Three Size Classes

When comparison of the three size groups was made, regional effect, distance to and size of the nearest large centre accounted for the greatest variation due to growth in each size group. Only one other variable, employment in primary occupations, proved to be prominent in the second

size class, 1,000 to 2,500, due to the growth of mining in the Northern and Lake Ontario regions. Usually, the regions varied considerably among one another in rank and percent variance from class to class. Although the Central Ontario area was generally among the higher ranking variables, it proved to be first in the 2,500 to 10,000 size class, fifth in the 1,000 to 2,500 size group and second in the 0 to 1,000 size category. The advantageous location in the most highly industrialized (Putnam and Putnam, 1970), populous and accessible area of Ontario resulted in rapid population gains in towns and villages. An unprecedented high economic growth which particularily benefited the Central Ontario area seems to have been the primary cause of the high rankings.

Regional influence dominated each of the three classes despite the fact that urban shadow was still a vital dimension. In each size group from highest to lowest the variance percent differences due to growth between regional and urban shadow were 8.5 percent, 10.7 percent and 8.3 percent. The higher regional influence is attributed to less disparity of population growth between centres located close to larger cities and those at periphery distances. With smaller differences of growth the effect of distance to and size of the nearest large centre was invariably tempered. This may be attributed to the rapid economic growth of Ontario which witnessed the expansion of industry, agriculture, commuting and recreation in towns and villages.

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Chapter IV

Population Changes During The Period 1961-1966

Ontario towns and villages experienced a slower growth rate from 1961-1966 than in the preceding decade with a mean of 4.6 percent as compared to 19.9 percent for the previous ten-year period. Even if the 1961-1966 growth figure were crudely projected until 1971 by increasing it three times for the 1966-1971 period, the value would still not equal the rate of increase witnessed during the decade 1951-1961. This slow population increase coincides with a relatively slow economic growth. A decrease in Ontario manufacturing rate (Ambrose, 1965) reflected the economic conditions which were accompanied by a reduction in immigration and natural increase rate (Dominion Bureau of Statistics, 1961), (Allan, James N., 1961).

The rapid economic growth in the previous period revealed the strong influence of the regional dimension in the growth of Ontario centres. Ray has suggested that:

> The rate of economic growth in Central Canada affects the rates of immigration, population growth, age and sex structure; cultural characteristics and housing. (p12, 1965).

With the reduced economic growth rate during the period 1961-1966 and the slower population gains, the influence of

urban shadow should increase at the expense of the regional dimension.

The correlation matrix bears this out, showing in order of importance size of place, size of nearest large city, distance, Central Ontario region and primary occupations (Table 37). The high correlation revealed by size of place indicated that an increase in the size of towns and villages signified increased population gains. On the other hand, a low negative correlation for primary occupations was recorded, revealing that primary employment was of less importance than in the previous period. Table 40 shows a 1.2 percent drop during 1951-1961, for employment in primary occupations in Ontario towns and villages. Continuing urbanization and a decrease in northern mining employment were instrumental in causing the low correlation for this variable.

> Two years within this period, 1959 and 1960, showed outstanding achievement, the value of mineral production in both years being nearly double the 1953 level. Although in subsequent years production suffered a setback, due primarily to a decrease in demand for uranium and a large build-up of inventories of copper and nickel (Ontario Department of Economics and Development, p28, 1966).

Corresponding with the correlation matrix, the summary table shows five variables to answer 34 percent of the variation due to growth in Ontario towns and villages (Table 38). These were size of place, distance to and size of nearest large centre, northern region and St. Clair area. The Central Ontario region, when weighed comparatively against the other variables, was removed by the stepwise correlation program. As suspected, a change in the economic conditions

relegated the regional effect to a position of lesser importance, answering only 6.2 percent of the variation due to growth, while the urban shadow effect increased in importance, accounting for 11.2 percent of the growth. The size of town or village dominated as the primary cause of growth and answered 19 percent of the variance in growth. This variable was found to be significant in other studies which showed that a decrease in size of place resulted in increased population loss whereas an increase in size meant greater gains (Radcliff, 1942; Brunner, 1944; 1951; Northam, 1963; Fuguitt, 1964; Hodge, 1966). The fact that this variable became prominent in only this period could reflect greater differences in population growth rate among the three size classes. During the period 1951-1961, rapid population gains, stimulated by great regional economic variations in growth, resulted in much less distinction between population accruements of larger and smaller places. Variations in economic growth of Southern Ontario have been shown by Kerr, D., and Spelt, J., (1960) and for Ontario by Ray (1965).

Table 37

Correlation Matrix 1961-1966

Variable		
2	Size of Place	.442*
3	St. Clair Region	.076
4	Lake Erie Region	-.107
5	Niagara Region	.140
6	Midwestern Region	.079
7	Georgian Bay Region	-.144
8	Central Ontario Region	.253*
9	Eastern Ontario Region	-.109
10	Lake Ontario Region	-.014
11	Northern Ontario Region	-.163
12	Population of nearest large centre	.370*

Table 37 continued:

Variable		
13	Distance to nearest large centre	-.297*
14	Percent employed in primary sector	-.294*
15	Percent employed in blue collar sector	.015
16	Percent employed in service sector	.190

*Significance at the .05 level

Table 38

Stepwise Summary Table 1961-1966

Variable Entered	Multiple R	RSQ
2	.441	.195
13	.499	.249
12	.554	.307
11	.571	.326
3	.583	.340
6	.590	.349
7	.596	.355
9	.601	.362
16	.608	.370
5	.611	.374

When residuals were excluded from the program, the position of size-of-place variable was relegated from first to third. Table 39 shows distance, size of nearest large centre and size of place, in that rank order, to be responsible for growth of centres. This strengthens the notion that urban shadow is a dominant force in this period, affecting towns and villages within the 30-mile radius. Moreover, the shift of these variables demonstrated the positive relationship between size of place and population growth to be more strongly represented in the high and low deviants.

Table 39

Stepwise Summary Table
(excluding residuals $< -.75$ and $> +.75$)

Variable Entered	Multiple R	RSQ
13	.447	.200

Table 39 continued:

Variable Entered	Multiple R	RSQ
12	.571	.327
2	.626	.392
7	.655	.430
9	.678	.460
14	.707	.501
5	.725	.525
6	.735	.541
15	.740	.547
11	.743	.555
3	.747	.559

Residuals

Residuals appeared evenly divided among seven of the economic regions (figure 9). Only in Lake Erie and Midwestern Ontario regions were there very few deviant centres. Remaining regions had virtually equal numbers of residuals greater than +.75 or less than -.75 standard units. Similarly, of high and low residuals, half were centres underestimated and half overestimated by the regression equation. When distance was studied, some relationship did appear as at least 23 of 33 underestimated centres (> +.75) were located within a 16 mile mean distance of cities such as Windsor, Sarnia, Chatham, Hamilton, Niagara, Welland, Toronto, Ottawa and Sudbury. The remaining 10 places were found in less accessible areas. Also found in less accessible areas and at distances approaching 30 miles were generally overestimated centres.

Size also seemed to be of significance as 32 of 66 residuals were in the 0 to 1,000 population range, while succeeding size classes, 1,000 to 2,500 and 2,500 to 10,000, had 21 and 13 deviants respectively. These differences reflected

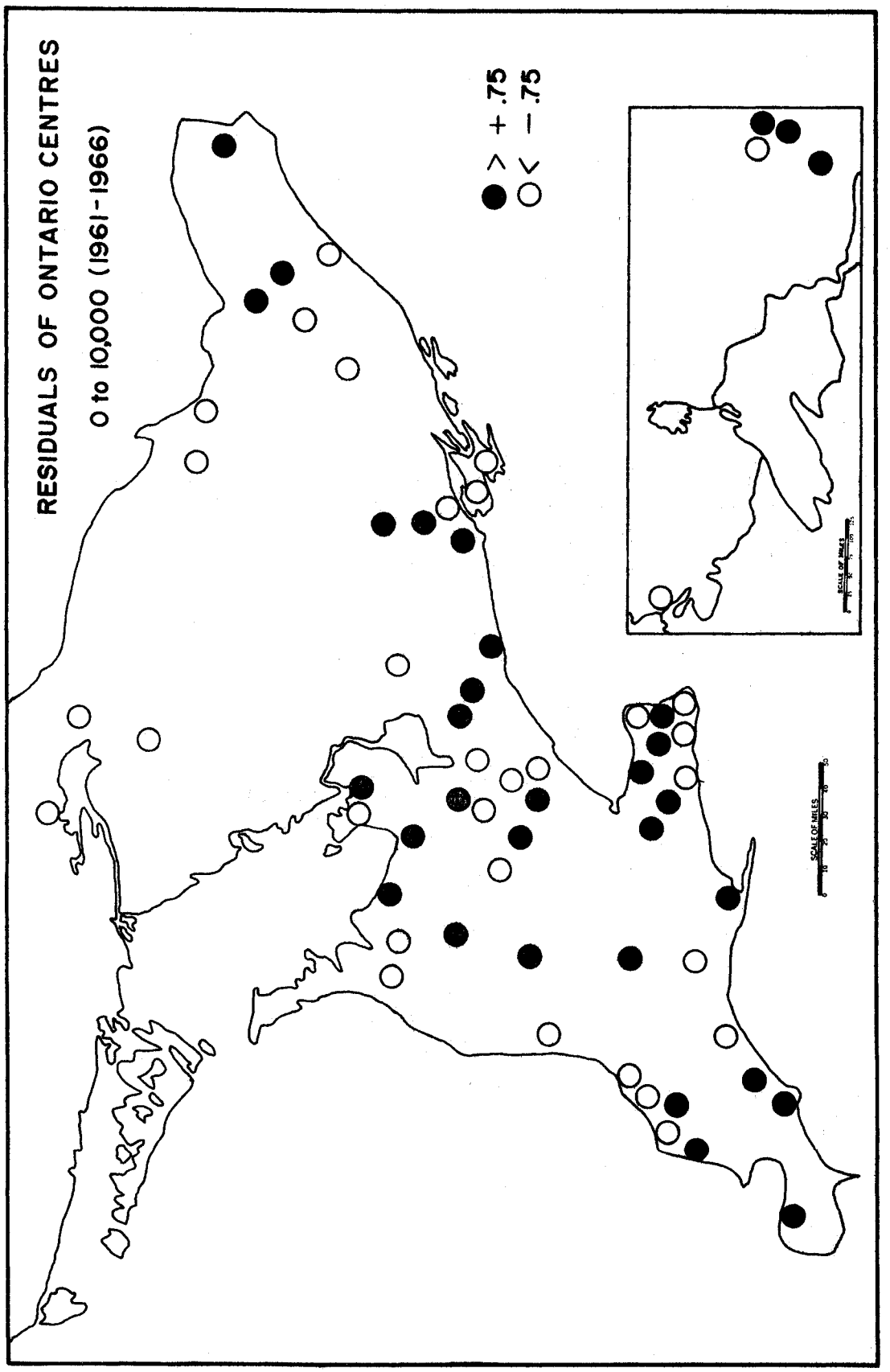

Figure 9

the previously discovered importance of size of place among the residuals.

Comparison of Size Class Means

Mean percent population change clearly reflected the size of place influence which proved to be the most important variable affecting growth of Ontario centres during this period. From lowest to highest size group, mean population increases were -.021 percent, 4.9 percent and 7.4 percent (Table 40). The standard deviation of mean growth decreased as size category increased, indicating less stable population growth in smaller places. In turn, growth appeared to be influenced by distribution and the two functions of urban shadow, distance to and size of nearest large centre. A tendency towards a greater scattering of places in the 0 to 1,000 population range was revealed whereas centres in the larger two size categories showed a propensity towards locating near nodal points (figures 10, 11 and 12). Bearing this out, the smallest size class had the greatest mean distance indicating the greatest distance range of 14.9 to 31 miles (Table 40). This placed these villages not only in areas that were less accessible to large centres but also were situated within greater distances of smaller cities with average population of 62,569. In the second and third size categories mean distances were 19.0 and 18.4 miles with standard deviations indicating general locational ranges of 11.2 to 27.2 and 8.0 to 28.8 miles respectively. Similarly, as size class increased, the size of nearest city increased, with the average population of the closest large city in the second

category being 101,517 and, in the third, 144,121. The closer mean distances and greater nearest large centre point to the importance of urban shadow in the second and third size groups, while increased distances and smaller nearest large centre suggest the dominance of regional effect among smaller municipalities.

Investigation of employment in occupational divisions disclosed a mean decrease in primary occupations with each succeeding increase in size category (Table 40). On the other hand, manufacturing was of virtually equal proportion in all size classes, a consequence of economic conditions reflecting a decrease in total manufacturing around 1960 (Ray, 1965). This, perhaps, was the result of two factors, more manufacturing acquisitions by smaller places and greater economic setbacks in the employment of larger towns already possessing manufacturing bases. The third occupational division, the service sector, employed greater numbers in the two larger size groups which were almost of equal proportion. A mean of 4.4 percent from the previous period occurred in the larger two size groups, while the lowest size class had only a small increase of 1.7 percent. This would indicate the increasing importance of service employment in the larger towns and villages.

Table 40

Variable	Class Size 0-1,000		Class Size 1,000-2,500		Class Size 2,500-10,000	
	Mean	SD	Mean	SD	Mean	SD
1	-0.21	12.4	4.9	7.9	7.7	7.4
12	62,569.5	----	101,517.6	----	144,121.2	----
13	23.0	8.1	19.0	8.2	18.4	10.4

Table 40 continued:

Variable	Class Size 0-1,000		Class Size 1,000-2,500		Class Size 2,500-10,000	
	Mean	SD	Mean	SD	Mean	SD
14	8.9	6.2	4.7	3.7	3.8	5.6
15	34.3	5.1	34.6	8.3	35.7	8.2
16	56.7	6.5	60.5	8.7	60.4	8.6

Size Class 0-1,000

Villages of less than 1,000 persons were located away from major metropolitan areas and were predominantly distributed in the periphery districts of the Lake St. Clair, Lake Erie and Georgian Bay regions. Places in the Lake St. Clair and Lake Erie areas were primarily small rural trade centres, and in the Georgian Bay district mostly recreational. When the correlation matrix was examined, only one of these regions was significant, St. Clair, while one other area showing significance was the Northern District (Table 41). Neither distance nor size of nearest large centre proved to be important although the latter approached significance.

The summary table revealed several regions-the Northern, Georgian Bay, St. Clair and Midwestern-accounting for 25 percent of the total 37 percent variance due to growth (Table 42). Answering only 9 percent of the growth, distance and size of place (urban shadow) were relegated to a position of secondary importance. The location as well as economic conditions seemed to be vital causes affecting regional growth. Although, in the previous decade, urban shadow and regional effect had a greater percent difference which was strongly influenced by the rapid economic growth, during this period the tardy economic growth did reveal a definite decrease in

difference between the two dimensions from 8.5 percent to 6.3 percent. Because the urban shadow dimension has been shown to be the dominant force in all centres, its secondary importance in the 0 to 1,000 population range is believed to be caused by increasing mean distance location of municipalities from the nearest large centre and the decreasing mean size of nearest large centre as has been revealed in mean comparison. Small incorporated villages are therefore decreasing in density near large cities because of transfer into the next size category. Large metropolitan areas of Windsor, Hamilton, Toronto and Ottawa have few small incorporated centres within a 30 mile radius. Increasingly, these villages are found in agricultural and recreational areas away from large metropolitan cities.

Table 41

Correlation Matrix

Variable	
2	.051
3	.301*
4	-.063
5	.155
6	.135
7	-.221
8	.135
9	-.105
10	.079
11	.327*
12	.247
13	.136
14	-.274
15	.136
16	.155

*Significance at the .025 level

Table 42

Summary Table

Variable Entered	Multiple R	RSQ
11	.327	.106
7	.422	.178
3	.472	.223
13	.512	.263
12	.565	.320
6	.585	.343
2	.592	.351
5	.600	.360
8	.605	.366
10	.608	.370
16	.609	.371
4	.609	.372

Residuals

Within the .75 standard error bounds a more normal growth was signified by a reduction of high and low residual centres from 32 during the 1951-1961 decade to 17 during the period 1951-1961. The overestimated villages were primarily small rural trade centres generally located more than 20 miles from the nearest large centre or were near a small city such as Owen Sound (Table 43) **(figure 10).**

Table 43

Rural Trade Centres

Grand Valley	Arkona
Springfield	Thedford
Chatsworth	Tottenham

Only Beeton, situated in a rich market gardening and recreation area, recorded a substantial population gain. Other high residuals were recreational service centres at Erie Beach, Port Rowan, Creemore and Latchford. While these places were within easy reach of large metropolitan areas, the centres of Westport, Sturgeon Falls and Thorloe in less accessible

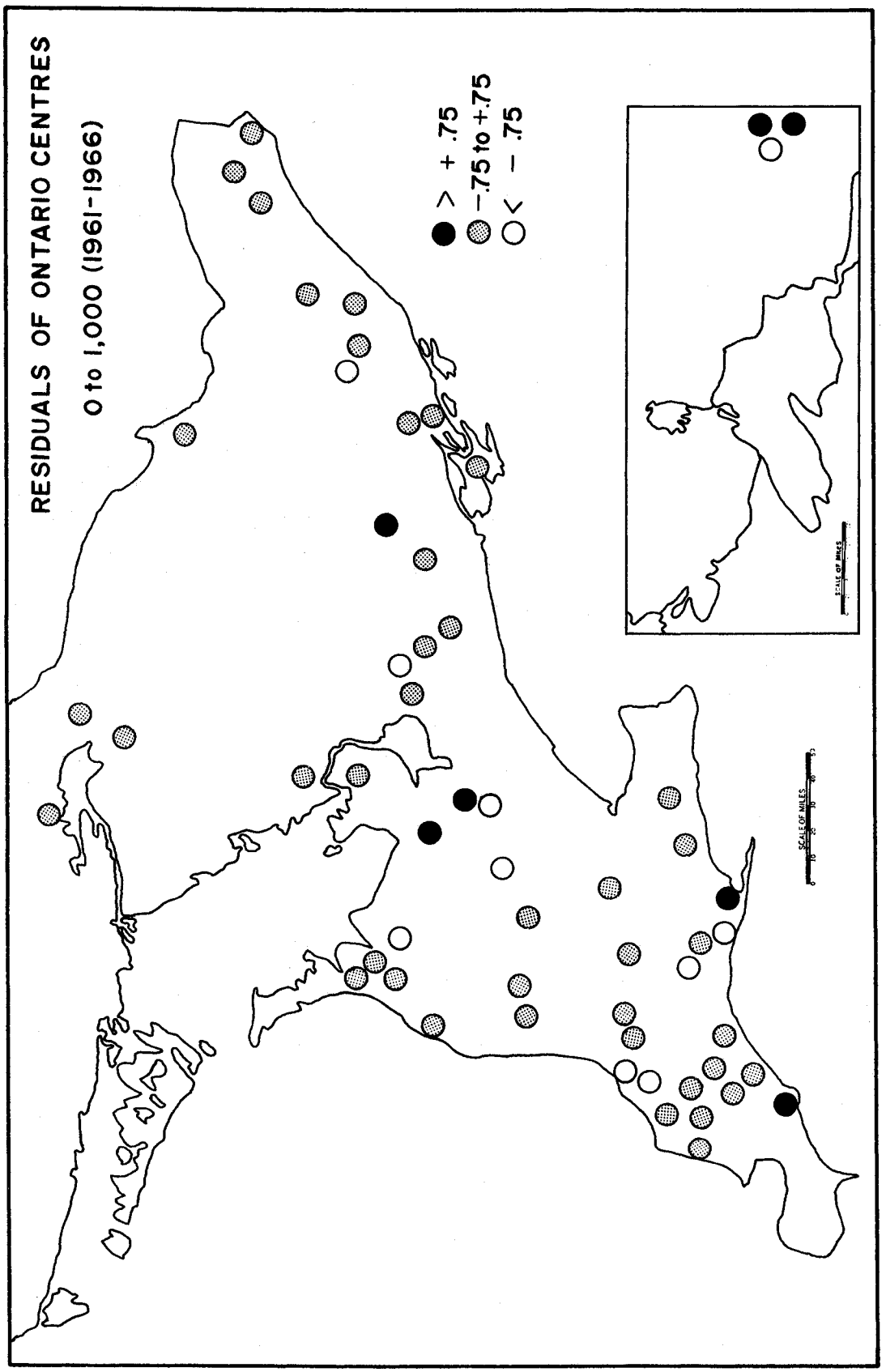

Figure 10

areas recorded population losses.

The remaining two centres of Deloro and Burwell were respectively a mining centre which had a rapid population growth and a port which suffered a population decrease with a decrease in trade functions (Boyce, 1967), (Ontario Department of Economics and Development, 1965).

Size Class 1,000 to 2,500

A low mean increase of 4.9 percent was recorded for municipalities in the 1,000 to 2,500 size group, with 12 or 20 percent of the centres sustaining population losses as compared with 3.2 percent in the previous period. Increased losses can be attributed to the slower economic growth. Communities experiencing population decrease were generally located at peripheral distance from cities. Nine of these places were situated more than 25 miles from a large centre and three between 20 and 25 miles. Figure 11 shows most centres to be around certain nodes which proved to be large urban centres. Of 72 places, 50 or 70 percent were located within a 20 mile radius of a large centre and 21 or 30 percent were within a 15 mile commuting zone. This pattern indicated the importance of the urban shadow effect. An examination of the correlation matrix shows that only the distance function is significant (Table 44) while the summary table reveals both distance to and size of nearest large place to be important (Table 45). Answering 3 percent of the variance in growth, the only prominent region was Lake Erie. These three variables were responsible for 34 percent of the variation due to growth. Perhaps the dominance of distance

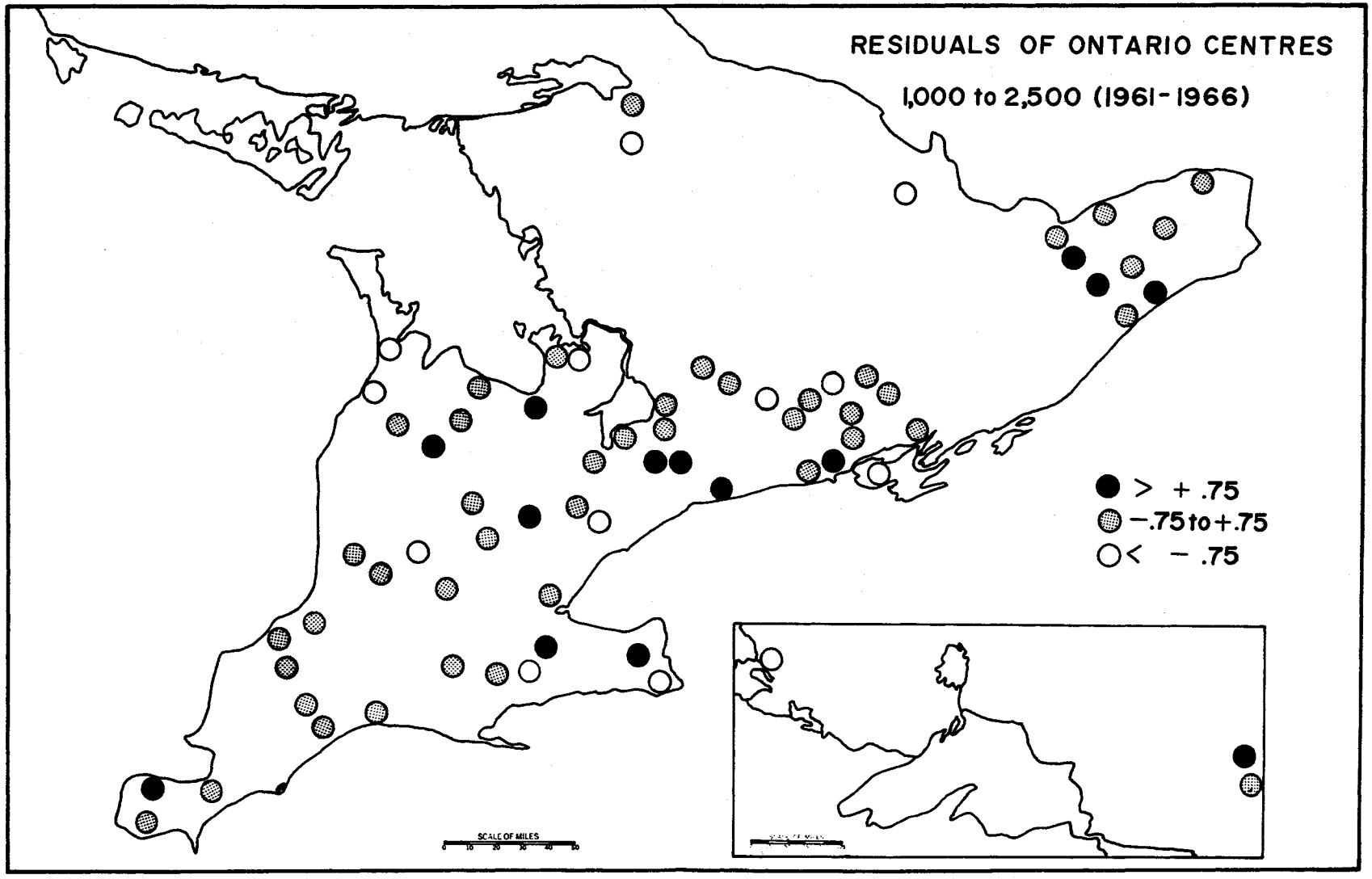

Figure 11

among these variables reflects the increased trend towards commuting throughout Ontario.

Table 44

Correlation Matrix

Variable	
2	.215
3	.054
4	-.145
5	.147
6	.070
7	-.006
8	.035
9	-.047
10	-.002
11	-.062
12	.182
13	-.494*
14	-.125
15	-.032
16	.077

*Significance at the .025 level

Table 45

Summary Table

Variable Entered	Multiple R	RSQ
13	.493	.243
12	.539	.291
4	.571	.326
5	.577	.333
11	.584	.341
16	.588	.346
3	.591	.349
9	.593	.351
8	.594	.353
14	.595	.354
15	.597	.356
6	.597	.357

Residuals

A cluster pattern was indicated by the underpredicted residuals which were located in close proximity to major cities. Serving as either commuting or commuting-recreation

centres, Table 46 shows that these underestimated centres were more than +.75 standard units from the regression equation.

Table 46

Commuting and Recreation Centres

Richmond*	Uxbridge
Fonthill*	Port Perry
Caledonia*	New Castle
St. Clair Beach	Brighton

*Primarily commuting

These municipalities were located at an average distance of 12.8 miles from such nearest large cities as Windsor, Hamilton, Welland, Toronto, Oshawa and Ottawa. On the other hand, low residual recreation centres such as Southampton and Wiarton were remote from large urban areas while Crystal Beach and Woodbridge, situated near large cities, for unknown reasons did not produce expected growth. Since both centres had shown rapid growth in the previous periods, no specific causes for this growth could be discovered.

Located away from large urban centres and gaining few new industries were low residual rural places. These centres were Hagerville, Keewatin, Thamesville, Milverton and Wellington. Milverton suffered from the phasing out of the C.N.R. car shops in Stratford during the late 1950's and early sixties while Wellington had lost population because of continuing rural depopulation on Prince Edward County. (Johnston and Johnston, 1967) (Thoman, Richard S., 1968). Only one rural centre, Erin had shown substantial population gain and this was due to the addition of new industries in the

village (Dryden and Smith, 1962; North Oxford Township Centennial Project, 1967).

Centres which acquired new industries and were becoming growth points in their areas experienced rapid population gains. The communties of Morrisburg, Kemptville and Durham were not only important agriculturally but were also becoming strongly manufacturing-oriented (Putnam and Putnam, 1970) (Thoman and Yeates, 1966).

Remaining centres which continued to register low population gains were Marmora and Victoria Harbour. Marmora experienced population losses with the closing of the cobalt plant in Deloro which had an unfortunate effect on its retail economy. Many small stores and businesses were consequently forced to close their doors (Boyce, 1967), while Victoria Harbour, due to the loss of its lumber trade in the early part of the twentieth century, had been steadily losing population (Spelt, 1955).

Size Class 2,500 to 10,000

Map distributional changes were caused during this period because of fewer annexations and the addition of 14 new centres which had moved from the 1,000 to 2,500 size class to the 2,500 to 10,000 size group. Figure 12 reveals distributions of towns along the Great Lakes and farther inland with locations near the large urban areas of Windsor, Sarnia, Welland-Niagara, Kitchener-Waterloo, Toronto-Oshawa, Ottawa and Sudbury. Investigation of mean distances to nearest large centre disclosed a decrease of 2 miles from 20.4 in 1951 to 18.4 in 1961. One-half of these towns were situated

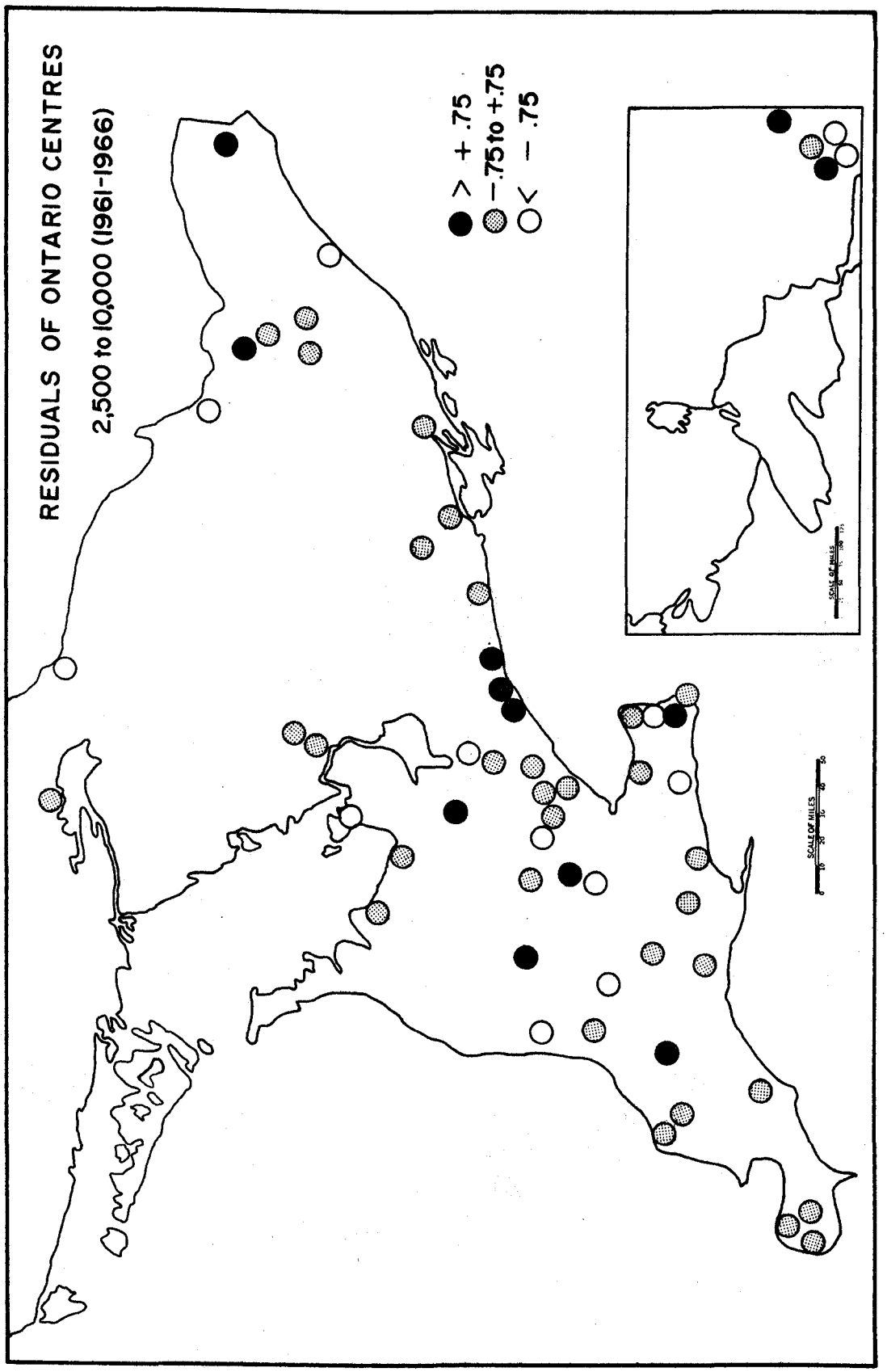

Figure 12

within 15 miles of a city compared with 35 percent during the previous period. With a slowing down of economic growth (Allan, J.N., 1962) and decreasing mean distance to nearest large centre, the strong influence of cities on Ontario towns should intensify.

Attesting to the effect of nearest large centre, the correlation matrix showed this variable to have the highest significance score (Table 47). Along with the size variable, the Central Ontario region and distance were also demonstrated to be significant. When intercorrelations between variables were removed the Central Ontario region shifted into fifth rank order behind the Niagara and Midwestern regions (Table 48). These areas answered 13 percent of the variation due to growth while size of nearest large centre and distance were responsible for 27 percent of the growth. With regional location being of secondary importance, the effect of urban shadow became dominant in this size group.

Table 47

Correlation Matrix

Variable	
2	.242
3	-.059
4	-.080
5	.237
6	.101
7	-.182
8	.401*
9	-.277
10	-.069
11	-.220
12	.409*
13	-.329*
14	-.189
15	.004
16	.133

*Significance at the .025 level

Table 48

Summary Table

Variable Entered	Multiple R	RSQ
12	.408	.167
13	.523	.274
5	.560	.314
6	.600	.360
8	.636	.404
10	.643	.414
16	.648	.420
4	.651	.423
3	.654	.428
15	.655	.429
14	.697	.486
7	.698	.487
9	.698	.487

Residuals

Figure 12 shows residuals to be more widely scattered than during the 1951-1961 period, which had witnessed greater concentration along the Great Lakes waterway. Located within close proximity to large urban areas such as Kitchener-Waterloo, Welland, Toronto-Oshawa, Ottawa and Sudbury were mostly underestimated centres (> +.75 SD). The towns of Whitby, Bowmanville, Hespeler and Almonte had gained new manufacturing firms or expanded those already present, resulting in the need for more employment. In the early and late 1950's Bowmanville gained beverage, chemical, automotive and canning firms which increased its population rapidly in the 1951-1961 and 1961-1966 periods (Trevelyan, G.M., 1958). Another example is provided by Whitby which attracted the companies of Dupont and Lake Ontario Steel and expanded the Andrew Antenna Corporation (Winter, B., 1967). Unlike these places, Ajax and Chippewa were not manufacturing towns but instead served as living quarters for many city commuters. The town

of Chippewa also depended greatly on tourist trade for its survival (Bond, C.R., 1962).

Situated within 15 miles of Sudbury were Coppercliff and Conniston, two overestimated centres ($< -.75$) which had experienced little or no population gain due to the large build-up of inventories of copper and nickel and the decreasing world demand (Ontario Department of Economics and Development, 1966). Towns which did show population gain in the Northern district were Chemsford, the market centre of the Sudbury area and Haileybury, an administrative centre of the Little Clay Belt of Tamiskaming.

In low residual towns generally located away from large urban areas and displaying slow industrial gains, a slower population growth took place. These places were Clinton, Mattawa, St. Mary's, Thorold, Prescott and Pentaguishene. The towns of Thorold and Mattawa were noted for one particular industry, pulp and paper and electrical output, respectively, while others, St. Mary's and Clinton, were as yet largely rural centres. Also rural in nature were the towns of Strathroy, Listowel, Alexandria and Renfrew. These places were mainly concerned with light manufacturing and agricultural processing which have proved important for their survival. An example is Strathroy which served as an industrial centre and as a business centre for the surrounding agricultural district (Mitchell, P., 1960). The prospects for population growth of these centres will depend on their continued ability to attract new industry, often in the

form of processing plants which would serve the surrounding agricultural areas.

Comparison of Three Size Classes

The most important factor influencing growth of Ontario towns and villages within a 30 mile radius of a dominant centre was the actual size of place. Increase in size class resulted in greater population gains while the possibility of losing population in larger centres was greatly reduced. Bearing this out were the population mean growth figures which indicated that smaller places had slower and more unstable population gains than larger centres. When individual size groups were inspected, the size of the place did not register as important because of smaller population size intervals within each size group.

In the two larger size classes, urban shadow (distance to and size of nearest large centre) proved to be the most notable, while the regional effect was prominent in the 0 to 1,000 population range. Investigation of mean distance revealed the two larger size categories to have locations nearer to larger cities than the smallest size group. The smallest size class was found to have its villages situated at distances approaching the 30 mile radius with a resulting scattered distribution, while the two larger size groups radiated towards large urban areas.

Because of the movement of villages from the 0 to 1,000 size-class to the 1,000 to 2,500 size-category the radial distance locations of small incorporated villages was moving

increasingly away from large cities. This has often been caused by increased commuting of people to smaller places that are located in close proximity to cities. Consequently, more centres in the 1,000 to 2,500 population range are becoming satellite centres of large cities. The growth of Ontario towns and villages in the 1961-1966 period was thus proportional to their size and directly related to the distance and size of nearest large centre.

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Chapter V

Conclusions and Results

The purpose of examining three time periods was to analyze and interpret the comparative importance of the selected variables in order to account for the percent variance in population growth of Ontario towns and villages. In addition to a single variable inquiry, the grouping of variables into common dimensions made it further possible to compare temporally the influence of local, regional and internal economic structure on towns and villages. These were, respectively, urban shadow, economic-regional location and occupational categories. One further line of investigation was the examination of residuals ($< -.75$ and $> +.75$) which were not accounted for by the postulated variables. Investigation revealed that residual centres could be grouped according to economic types and location. This was done in order to discover other variables which might be examined in future studies.

Urban Shadow Variables

The rank orders and percent variance accounted for bear out the temporal stability and overriding importance of the urban shadow functions, distance to and size of nearest large centre, affecting population growth of Ontario towns and villages situated within a 30 mile radius of the nearest

dominant centre. When places in the 0 to 10,000 population range were considered for the three time periods, these two variables were among the first three ranking variables.

In the individual size groups, however, greater variation was evident. The first size class, 0 to 1,000, suffered a decline in ranking of distance to and size of nearest large dominant centre from the first position during 1941-1951 to the third during the 1961-1966 time period. Indications were that these variables were becoming less stable during the 25 year span. Variance growth , accounted for by distance, declined from 14.9 percent to 4.9 percent and 4.0 percent in each succeeding period while size of nearest large centre displayed similar changes, answering 6.3 percent, 5.1 percent and 5.6 percent of the growth. Only a slight increase of .5 percent took place for the size variable in the final 1961-1966 time interval.

An increasing mean distance of 20.4, 22.9 and 23.0 miles from small villages to nearest dominant centre was a probable explanation for the decreasing influence of urban shadow variables. This would suggest a rearrangement of location for villages in the 0 to 1,000 size category as village densities decrease in close proximity to cities and increase towards the 30 mile periphery. Further proof was provided by the standard deviation, which was both subtracted from and added to the mean distance in order to arrive at locational distance boundaries within which villages were located. In each succeeding time period these boundary ranges were 12.6 to 28.0 miles, 12.3 to 32.0 miles and 14.9 to 31.0

miles. In major urban areas it is inevitable that, as cities increase in size and project their populations into the small surrounding villages, such places will become large dormitory towns or small cities unless specifically restrained. Increasingly, small incorporated villages were situated in less accessible areas near small cities with agricultural districts and recreation areas but away from large metropolitan cities. As clearly demonstrated in figure 10, few, if any, small incorporated places in the size class 0 to 1,000 were located within a close distance to the large metropolitan areas of Windsor, London, Kitchener-Waterloo, St. Catherines, Hamilton, Toronto-Oshawa, Ottawa and Sudbury.

In the second size class of 1,000 to 2,500 the urban shadow functions ranked in the first two positions during the 1941-1951 decade and the 1961-1966 period. Distance answered 11.9 percent and 24.3 percent of the variance in growth while size of nearest large centre accounted for 36.7 percent and 4.7 percent. During the decade 1951-1961, a shift to third and fourth rank orders took place, with distance accounting for 9.2 percent and size of nearest large centre for 8.4 percent of the variance in growth. In both cases, however, only a small difference of .63 percent and 1.37 percent existed between these variables and the second ranking factor, primary occupations. The high rank order of these variables over the three time periods revealed their strong influence and stability in places containing 1,000 to 2,500 people.

Within each time period, mean distance locations revealed that the 1,000 to 2,500 group had the shortest spacing boundaries and, therefore, a less scattered distribution. Locational boundaries of these places, 12.4 to 26.2 miles, 10.1 to 27.5 miles and 11.2 to 27.2 miles remained relatively stable. Balancing losses incurred through shifts of centres into the 2,500 to 10,000 population range were villages in close proximity to large cities which were gained from the 0 to 1,000 size category. Many of these municipalities were satellites of nearby large cities. Figures 3, 7 and 11 show many places to have been located in areas of large metropolitan cities even though a number of these had shifted into the 2,500 to 10,000 size group during the final 1961-1966 time interval.

Greatest fluctuations of distance to and size of nearest large centre were exhibited within the third size class of 2,500 to 10,000 which showed only one of these indices to be prominent in each of the first two decades. In the first period, size of nearest dominant centre accounted for 23.4 percent of the variation due to growth and, in the second period, distance contributed 11.7 percent. The drop in rank order of the size variable occurred concurrently with a decrease in the average size of the nearest large centre from 136,364 to 105,193. Because many towns such as Aurora, Richmond Hill, Long Branch, New Market and Brampton, near Toronto, were undergoing annexations in the 1951-1961 decade, their exclusion affected the mean size of the nearest large

centre. In 1961 many of these towns which had not surpassed the 10,000 population mark were again included along with new centres from the 1,000 to 2,500 size category. Subsequently this caused a mean population increase of the nearest large centre from 105,193 to 144,121 and the importance of this variable rose to first position, contributing 16.7 percent variation due to growth.

Fluctuations in the urban shadow indices reflected not only the change in mean size of the nearest dominant centre but also the greatest range of distance distributions. In each succeeding time period these ranges were 8.6 to 28.4 miles, 8.6 to 32.2 miles and 8.0 to 28.8 miles. This would indicate a more even distribution of towns within a 30 mile radius of cities. Such places were found in locations close to large cities, often acting as industrial and population extensions, or were situated either between or outside the large city hinterlands in strategic positions controlling their own umlands.

Regional Variables

Although the use of Ontario regions has certain limitations since these divisions are largely generalizations combining economic and structural factors, it is desirable to establish the regional variations in centre growth and the causes for them. This facilitates a better understanding of town and village growth and, ultimately, of the influence imparted on centres because of certain regional locations.

Economic regions have varied in importance in relation

to different size groups according to economic conditions prevalent during certain times. Affecting a strong regional growth of centres at any location within a region can be a number of economic situations such as expanding national and world markets, better roads and transport, decentralization of industry, and expansion of existing plants. These situations caused a decline in the effect of distance to and size of nearest large centre (urban shadow) since various centres may grow independently at various distances regardless of the size of the nearest large centre. On the other hand, the increase in provincial population usually had beneficial effects on agriculture as the demand for foodstuffs increased, coupled with an increasing demand for recreation as people desired to relax and play away from large cities. With the rapid expansion coming after the war and during the decade 1951-1961, most of these economic conditions were prominent.

In the early 1960's a reversal of many of these trends occurred with slower population growth, slackness in manufacturing industries and construction and loss of local markets to foreign competitors (Allan, 1962). Consequently, these factors often varied in importance during the 25 year period in various size classes, according to the economic conditions prevalent in a region. For instance, manufacturing has usually been demonstrated to be instrumental in the growth of larger size towns while recreation or agriculture have been of importance among smaller places. Commuting has generally been prevalent in centres of the 0 to 1,000 and 1,000 to 2,500 size classes, although larger places such as those

in the Toronto area may be concerned with both commuting and manufacturing.

Some of the economic areas with strong regional influence in centres belonging to different size categories during various periods were the St. Clair area, Northern area, Georgian Bay, Central Ontario and Niagara. Displaying little or no impact were the regions of Lake Ontario and Eastern Ontario. The remaining Midwestern and Lake Erie regions have been influential only during specific time periods.

In the first size class, 0 to 1,000, the St. Clair region showed signs of some temporal stability, shifting from second position with 7.2 percent to first with 7.6 percent from the 1941-1951 period to the 1951-1961 decade. This change reflected the economic growth leading to great expansion in automobile production, chemical manufacturing and agricultural processing. Many small villages experienced expansions in existing agricultural plants or the addition of new ones. Toward the end of the 1950's the automobile industry suffered a severe setback and initial chemical expansion slowed in the early 1960's. This resulted in the St. Clair area dropping to fourth position and the region contributed only 4.4 percent to Ontario village growth.

Generally a slow population growth area, Georgian Bay displayed an increased growth in villages of the size category 0 to 1,000 during the latter two periods. With the growth of recreation, numerous small places became important as service centres for cottagers and surrounding recreational areas. The easily accessible Toronto metropolitan

region has continued to exert pressure on this area for more recreation facilities and services. Consequently, the variance due to growth increased from 3.2 percent during the 1951-1961 period to 7.1 percent in the final decade.

In the second size group, 1,000 to 2,500, the Northern region moved from third rank order in 1941-1951 to first in 1951-1961 and to fifth during 1961-1966. The percentage of contributed variation increased by 9.1 percent from 5.0 percent to 14.1 percent and then decreased by 13.3 percent to .83 percent respectively. World markets largely dictated the fluctuations of the mining industry which grew quickly from 1941 to 1959, then declined between 1960 and 1964.

The Central Ontario region containing the largest city in Ontario, Toronto, decreased from first rank with 17.2 percent in 1951-1961 to sixth position in the final period with 4.4 percent of the variation due to growth in towns of 2,500 to 10,000 size category. According to Ray (1965), this area experienced one of the greatest economic expansions during the period 1947-1960. During the same period Central Ontario also ranked second in village growth in the size class 0 to 1,000 which accounted for 5.7 percent of the variation due to growth. In the 1961-1966 period, slowing down of economic growth reduced the importance of this area.

The final region to show any effect on the size of towns in the class 2,500 to 10,000 was the Niagara area, accounting for 1.1 percent of the growth during the decade 1951-1961, and 4.6 percent during the period 1961-1966. Substantial

growth was demonstrated in the latter period by many of the towns with port facilities along the Welland Canal. This region also had high rank order in the 0 to 1,000 size group during 1941-1951 and in the 1,000 to 2,500 size group during 1951-1961.

Two economic divisions which displayed little effect in variation due to growth of towns and villages were the Lake Ontario area and Eastern Ontario region. These divisions, however, also experienced the least manufacturing growth in the post war era. According to Ray,

> Lake Ontario and Eastern Ontario regions have had a retarded economic development in manufacturing. (1965 p7)

His indication that economic growth in Central Canada was an important indicator of population growth would explain the low ranking achieved by these regions in town and village growth.

Occupational Employment Variables

Weakest results achieved were by the three occupational employment variables, primary, blue collar and service. Only primary employment demonstrated any relationship with population growth in the 1,000 to 2,500 population range during the 1951-1961 decade and in towns of the 2,500 to 10,000 size range during the 1961-1966 period. This was attributed to the growth of northern mining which required labour in these size classes. Further causes for the mediocre results of these variables will be dealt with at greater length in succeeding sections.

Size of Place Variable

Perhaps the most unusual variable was the actual size of town or village which is supposedly sensitive to differences in population growth among places. Using the stepwise correlation program, however, this was not the case in the first two decades which did not witness any noticeable variations in growth between towns and villages of different size classes. Using an adaption of the percent tables, as demonstrated by Radcliff (1942) and Brunner (1944 and 1951), means of growth was employed to show that an increase in size class resulted in greater population gains during the first two decades.

Only in the 1961-1966 period did this variable register as being of significance within the stepwise correlation program, accounting for 19.5 percent of the variation due to growth. This was considerably higher than demonstrated by Hart and Salisbury (1965) and Traver and Beale (1968) who discovered that size of place answered 8.0 percent and 9.0 percent of the variance due to growth. In the first two time periods, fewer growth differences were exhibited by various sizes due to the rapid economic growth. As a result of economic expansion, both small and large places displayed rapid population gains, often at varying distances as demonstrated during the 1951-1961 decade. During the final period, a greatly slowed economic growth rate brought out greater differences in population gains between larger and smaller places.

Comparison of Dimension: Urban Shadow; Regional Location and Occupational Division

When the variables were grouped into three dimensions, ie., urban shadow (distance to and size of nearest large centre), regional location (nine economic divisions) and the occupational employment division (primary, blue collar and service), it became possible to compare and ascertain the strongest dimensional influences on the growth of Ontario towns and villages.

It has been demonstrated through time series that the two most stable and highest ranking variables were distance to and size of nearest dominant centre, while regional influence varied greatly and occupational employment variable had virtually no effect on town and village population growth. Variance aggregates of these first two dimensions, however, reveal that this was not always true. In Ontario centres of 0 to 10,000 population range, the first and last time-periods were dominated by the urban shadow dimension with a total variance due to growth of 28.5 percent and 11.2 percent as opposed to 10.0 and 6.2 percent due to the regional location. In the second decade, 1951-1961, the two dimensions were virtually equal with urban shadow contributing 13.0 percent of the population growth and regional location 14.4 percent.

These changes coincided with the economic situation in which the city dominance of towns and villages represented the effect of local conditions generally radiating from the nearest large centre, while regional effect was normally the

result of external economic stimuli. In the first period, the strong influence of urban shadow in centres of the 0 to 10,000 population range was greatly distorted by places of the 1,000 to 2,500 size class which recorded a particularily strong urban shadow effect. The remaining two size groups had much smaller differences between these two dimensions. Closer inquiry of these size groups should yield explanation of this disparity.

The first part of the decade, 1941-1951, had been devoted to the war cause and, therefore, the larger urban centres were centralized areas vital for war-time production. Thus these centres affected surrounding towns and villages. Only towards the end of this decade did changing economic conditions bring about some shift in the importance of the nearest large centre in favour of the regional location factor.

Distorting the normal effect of distance and nearest large centre, regional growth was often influenced by economic factors emanating from outside the region. During the period 1951-1961, this took place as a period of rapid economic growth affected population gains with little regularity as to distance or size of nearest large centre. This regional influence became prominent during the period of expanded world and local markets for both manufactured and agricultural goods, decentralization of industry and improved transport and travel. Declining industrial production, stronger competition from foreign firms and slackened population growth, particularily in the first two years of the 1961-1966 period, reflected the

slowing down of economic growth. This coincided with strong influence characterized by the urban shadow dimension.

The third dimension, occupational employment structure, contributed little to the explanation of total variation due to growth in the 0 to 10,000 population range. Within each time period less than one percent of the variance due to growth was accounted for by the three variables of primary, blue collar and service occupations.

Individual size classes, however, revealed greater differences in percent variation due to growth and the effect of more specific economic conditions. Urban shadow dominated centres in all size categories during the decade 1941-1951, and the 1,000 to 2,500 and 2,500 to 10,000 size groups during the period 1961-1966, while in all size groups in the 1951-1961 decade and in the first size group of the 1961-1966 period, the regional effect was most significant. Centralization of industry during and immediately after the war may have affected the urban dimension which showed signs of weakening in the first and third size classes. Differences in these two size groups of 2.0 percent and 5.3 percent would reflect the increasing expansion and decentralization of industry into these centres towards the end of this decade. This is demonstrated by the higher percent recorded by towns of the 2,500 to 10,000 size group, which were more closely associated with manufacturing than smaller places.

Between 1951 and 1961 decentralization of industry continued particularily into larger centres. This movement of industry coincided with more recent historical accounts of

Ontario towns and villages which gained new industry or experienced expansion of existing plants. In small places specializing in agriculture, expansion in local dairy, packing and canning operations occurred due to the growing city populations and their increased consumption. With the demand for more labour, populations of most Ontario towns and villages rose substantially. This caused a strong regional impact on places which grew quickly in many Ontario economic areas. Results in each size category from lowest to highest revealed the fact that regional location contributed 18.5 percent, 28.4 percent and 20.8 percent as opposed to urban shadow with 10.0 percent, 17.7 percent and 12.5 percent. Hay suggests that:

> Periods of restrained economic growth or recession have had a tendency to halt or reverse trends towards the dispersion of manufacturing activity, at least in Ontario. Weak economic growth persisted in 1958 and 1959. (pp374-375, 1960)

This trend continued into the early 1960's and undoubtedly reduced the importance of the regional dimension in centres of 1,000 to 2,500 and 2,500 to 10,000 size classes. Furthermore, increased commuting to centres of these size categories, many of which were located in close proximity to larger cities, also strengthened the urban dominance.

The trend towards commuting resulted in many villages of the 0 to 1,000 size group moving to the next size class during the 1951-1961 and the 1961-1966 period. This decreased the density of such centres within close proximity to large cities and increased their mean distances and locational distance ranges. Consequently in the final period the urban shadow

was greatly weakened in villages accounting for 9.6 percent of the variation in growth, while regional location accounted for 15.9 percent.

Occupational employment dimension demonstrated noticeable variance due to growth in only two size classes. During the decade 1951-1961 the 1,000 to 2,500 size category accounted for 10.2 percent of the growth due to this dimension. This was primarily due to increased employment in mining which coincided with the high rank order of the Northern region. Finally, the 2,500 to 10,000 size group during the period 1961-1966 was of some importance, contributing 6.1 percent of the variance in growth. Of this, 5.7 percent was accounted for by employment in primary occupations. Towns with high employment in primary occupations such as Capreol, Chemsford, Conniston and Haileybury which moved from the second size category in 1951 to the third by 1961 may have been responsible for this occurrence.

Residual Groupings

Examination of residuals in this study has demonstrated that certain kinds of centres such as recreational or commuting, given the proper conditions and time, may initiate a rapid population growth. These may be combinations of physical, technological, psychological or social conditions causing the movements of people or industry into a town or village. Finding causes for such growth of centres becomes difficult because they are subject to rapid change and may not appear in succeeding periods.

From investigation of residuals, however, it was possible

to determine certain general types of Ontario centres displaying growth outside the normal standard bounds (>+.75 or <-.75). These centres have not been adequately explained by the postulated factors and are the result of other possibly unknown variables. Most places more than +.75 standard units and less than -.75 standard units displayed high and low population gains respectively, according to the actual size of the centre. Generally these centres fell into certain locational arrangements which made it possible to group them by their economic bases.

The underpredicted or high growth in Ontario villages proved to be commuter, recreational, rural or agricultural, and sporadic growth places. Larger towns and some villages in the 1,000 to 2,500 size category were primarily centres concerned with manufacturing and commuting and places relying on a particular resource.

(a) Commuting centres were located near large cities, many within a 15 mile radius. Increasing quickly in population, many of these places changed size groups from the 0 to 1,000 to the 1,000 to 2,500 population range. By 1961 such changes resulted in fewer incorporated villages of the commuting type remaining in the former size class, as most had shifted into the latter.

(b) Recreational centres, located at periphery 30 mile distances from smaller cities but with good access routes to large urban concentrations, grew rapidly. As recreation became more popular, an increased growth of these centres occurred in the final period. Many villages served nearby

recreation areas of cottagers, campers or sporting enthusiasts.

(c) Rural or agricultural centres not necessarily located in close range of large cities but in rich agricultural districts displayed substantial growth. In particular, villages which served not only surrounding populations but also as processing or packaging centres for the area exhibited high population growth.

(d) Sporadic growth places refers to several types, mining, recreational and one resource. These places grew for varied reasons such as markets, popularity, desirability or demand.

(e) Manufacturing towns either were primarily located close to large urban areas, often extensions of larger cities, and even serving partially as commuting places or were outside the immediate scope or hinterland of cities controlling their own umlands but in accessible areas to other towns and cities.

(f) Certain resource-oriented towns, with limestone, pulp and paper (logging) and mineral mining located nearby or inside the town, depended on that resource for their growth. Many were able to supply and build up their industries often associated with the resource. Also in an advantageous position, supplying their own industries, were port towns which depended on their port handling facilities for continued growth.

Overpredicted centres with slow growth or declining populations were primarily small villages located away from large urban areas. These were rural service centres, recreation centres, competing centres and sporadic growth centres. Larger residual towns were primarily commuting satellites.

Some industrial centres which did not gain new industries grew slowly. However, the latter type of places generally appeared irregularly over the 25 year period.

(a) Agricultural trade centres located at greater distances from urban concentrations were in slowly developing agricultural regions, many of which had been declining or stagnating since the beginning of the century.

(b) Recreational centres were often located at greater distances away from larger cities and in less accessible areas.

(c) Competing centres, generally, were small villages with service functions which faced competition from a larger village or town in close proximity. Recreation centres often had to compete with places of similar facilities in intercepting positions to large urban areas. Competing centres were not able to grow at the rate of the place nearby, which at times recorded as a high residual.

(d) Sporadic growth places were villages which when not growing rapidly were declining in population. These tended to be mining or one-resource places which grew according to market demands for their minerals or goods.

(e) Satellite towns primarily concerned with commuting and some industry displayed slower growth. Noted particularily in the Toronto area, these places were not able to gain population at the rate displayed by similar sized towns involved mainly in manufacturing.

Comparison of Results to Other Studies

Compared to former works the percentage variation due to population growth of towns and villages accounted for by the

variables in this study has been very favourable. Hart and Salisbury (1965), using two variables, size of place and distance to nearest large centre, were able to account for 22 percent of the growth, while Tarver and Beale (1968), employing four variables, size of place, regional location, county seat status and distance to nearest large place, were able to answer 17 percent of the growth. In attempting to account for spatial differences in population growth which occurred in the decade from 1940 to 1950 in 86 outlying cities within the Chicago urbanized area, Thomas (1960) utilized 9 independent variables, population, density of population, cost of housing, birth-death differential, age, quality of schools, number of persons engaged in manufacturing, accessibility from central city and amount of vacant land. These variables accounted for 36 percent of the variation due to growth. Results of variables in this study investigating towns and villages of populations less than 10,000 and within a 30 mile radius of a large centre with a population of 10,000 or more, have generally answered 30 percent or more of the variation due to growth. Of the four size categories (including 0 to 10,000) during the three time periods six or one-half answered between 30 and 40 percent of the variance in growth while 2 or 16.6 percent answered 40 to 45 percent and 4 or 33.3 percent accounted for 45 percent or more of the population growth.

The lowest variations due to growth were normally among the 0 to 1,000 size groups and the highest in the 1,000 to 2,500 and 2,500 to 10,000 size classes. In part, this reflects

less stability of growth among smaller centres which are subject to changes much more rapidly than larger places.

Implications of The Study

This study was developed to gain a better understanding of how certain variables, found to be important by writers in other areas, affected the growth of Ontario towns and villages during a 25 year period. As data were available, these variables were particularily suited for time series investigation. The difficulties of including other variables arose out of insufficient data for the earlier part of the study undertaken. Moreover, investigation of residual centres which did not grow according to the selected variables brought out new variables which appear to be important.

During the 25 year period, three variables appeared most prominent: distance to and size of nearest large centre, and the regional location.

The importance of distance to and size of nearest large centre would suggest that, as cities increase in population, they will readily absorb surrounding centres into larger urban masses. This has been well demonstrated by the increasing shifts of small villages away from large cities as those within close commuting ranges move into subsequent population size classes. If the mass urbanization example of Toronto is to be avoided, in which small towns and villages were allowed to grow into dormitory cities of 20 to 50 thousand people, then more careful study of large urban areas such as Hamilton, Kitchener-Waterloo, London, Ottawa and Windsor should be implemented. Perhaps this suggests the creation of

new cities or a population ceiling on the cities mentioned. Such a venture no doubt requires incentives by government in order to succeed.

The regional variable has shown centres within such regions as St. Clair, Georgian Bay, Central Ontario and Niagara to display strong growth while the centres of Lake Ontario and Eastern Ontario displayed little impact. This would suggest careful study of regions displaying slow town and village growth in order to develop a policy of more balanced and evenly distributed growth. In turn, the prevention of mass urbanization and congestion in the strong growth regions might be prevented. Moreover, the development of any new growth cities might be considered for these slow growth areas.

In any future planning of regions, high and low growth residuals must be considered. It is suggested that the groupings established here should lead to some growth predictability of a centre after having considered its location in relation to the nearest large centre, size of nearest large centre and the region within which it is located. By being able to predict the rapid growth or decline of centres, policies can be planned so as to minimize the effects on local government on housing and on investment in small places.

Further Study

While the occupational dimension has proven to be of little influence on towns and villages, this study has shown the importance of the urban shadow effect and regional location. Since percentages were used to represent only three occupational sectors, it is possible that there was not

enough diversity within each sector to register in the stepwise correlation program. Perhaps, in future work, it would be advisable to utilize employments by several occupations such as mining, agriculture, manufacturing, construction, retail and professional. This should create more diversity, in order to register as a definite factor. Moreover, residuals, typified by centres in which manufacturing, mining, agriculture or retail endeavours were of importance, lead to the conviction that such occupational structures would raise the importance of this dimension. Other variables that could also relate to the economic structure of these residual centres might be percent of total capital expenditure by manufacturing firms, total retail sales and total value of agricultural processing.

Locational arrangement of residuals suggests several variables not accounted for which might be important in answering further variation in population growth (King, 1969). A variable implied by residual locational arrangement but not considered was accessibility, in terms of the road system to major urban areas. Undoubtedly, a number of excellently surfaced highways would render an area more easily accessible to a large city than a similar place with a smaller number of poorly surfaced roads. This variable is suggested by location of residuals at distances both near to and farther from large cities. Greater accessibility of centres near large cities should aid in accounting for the rapid influx of peoples into them. Utilizing the functional or service

classification of highways provided by the Ontario Department of Highways Planning Branch, this variable could be included in the simple stepwise correlation program. Another method could utilize traffic flows as an index of accessibility. Because these studies have only been carried out since the 1960's, such methods are disadvantageous for retrospective inquiries. To overcome this difficulty, the number of roads into or near a centre might be more easily obtainable employing maps of each time period.

Overestimated residuals which were deemed primarily satellite and industrial centres in close proximity to large cities reveal the impact of population and manufacturing on large cities. Suggesting an increased proportion of apartments, housing units, rent prices and rising land costs, these variables would take into account centres of rapid growth and underestimated residuals which have experienced slow or declining growth. Other overestimated residuals suggest the primary economic concern of small places such as manufacturing, administrative, recreational or agricultural services to be important in causing rapid or slow growth. Finally, distance to the nearest large centre should be varied to include distance to nearest large centres of succeeding greater sizes.

An examination of population age structure of small centres might also be useful in explaining growth. Perhaps this would account for residuals near large cities in which rapid population growth took place or at further distances with little population change. Such variables as percent of population 65 years or older, percent of population 25 to 65 years

of age and percent of population aged 25 years or less could be taken into account. Other factors might examine earnings of the family to find the type of families living in small centres.

Using these variables, a program of simple stepwise correlation or factor analysis could be employed. The advantage of the factor analysis is that it yields factor loadings and scores from which certain dimensions and their effect could be analyzed for Ontario centres.

Little work has been done on small Ontario centres. It is, therefore, time that Canadian geographers recognized the importance of examining the dynamics of growth and functions of small towns and villages which are becoming vital to the solution to the social and physical ills of the large metropolitan areas.

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Vitae

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