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THE ROLE OF RURAL DEVELOPMENT AND FARMERS' PREFERENCES IN
CHANGING THE VIABILITY AND SPATIAL DISTRIBUTIONS OF CENTRAL
VILLAGES

Michigan State University

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THE ROLE OF RURAL DEVELOPMENT AND FARMERS'
PREFERENCES IN CHANGING THE VIABILITY AND
SPATIAL DISTRIBUTIONS OF CENTRAL VILLAGES

By

Fatemeh Behforooz

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Geography

1985

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ABSTRACT

THE ROLE OF RURAL DEVELOPMENT AND FARMERS' PREFERENCES IN CHANGING THE VIABILITY AND SPATIAL DISTRIBUTIONS OF CENTRAL VILLAGES

By

Fatemeh Behforooz

This study identifies the processes of change in the functional viability and spatial distribution of different sizes of population and functions of central villages in southcentral Michigan in the periods 1950-1970 and 1970-1980, according to rural development, and rural families' shopping preferences. The application of revised central place theory aids causal explanations of change in the functions and patterns of central villages in a spatial, temporal and probabilistic framework. The majority of previous central place studies have focused on the whole urban/rural system of central places without concentrated study of the central villages of a region. Therefore, the major findings of this research complement previous central place studies, particularly in light of the scarcity of studies on the central villages, and will be useful for future central place studies. The recommendations of this

study for reallocations of central functions may be helpful for future regional planning in southcentral Michigan.

The findings of this research support the existence of the rank/size rule and hierarchical structure of central places among the central villages studied of three points of the study time. The spatial distribution of central villages was random in the first period of the study and tended toward dispersion in the second period. This implies that change in the functional viability of different classes of central villages causes changes in the villages' spatial distribution. The influences of rural development and farm and nonfarm families' preference for shopping in larger central places were found to encourage the growth of larger central villages and the considerable decline of smaller ones. The reallocation (polarization) of high order functions with their greater ranges in high order central villages seems inevitable, while the retention of low order functions with smaller ranges will characterize the small or lower order villages. The continuous decline of farm families and increase of nonfarm families in southcentral Michigan will continue to promote noticeable decline of smaller central villages and more polarization of central functions in higher order central villages or urban central places.

To My Teachers

And

To My Family

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study and on agricultural and rural development concepts and policies in the United States. I am indebted to Professor Bruce Wm. Pigozzi for his sincere concern and vital guidance on the basic structure of this research. His constructive advice on applying central place theory and its revision in this dissertation and his guidance on all of the quantitative procedures were essential and sincerely appreciated. I am truly grateful for his admirable patience, concern, responsibility and advice on my dissertation. My gratitude also goes to Professor Richard Groop for his guidance and patient assistance on the data classification methods in geography.

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CHAPTER ONE

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Purpose Of The Study

This study was done to analyze changes in the functional viability (retail and wholesale trade and services) and spatial distribution of different sized central villages in southcentral Michigan and to explain the causes of such changes over the 1950-1980 period, through the application of revised central place theory. Revised central place theory, with its temporal and probabilistic (humanistic) objectives, was useful for resolving the problem of this research in an explanatory framework.

Classical central place theory (Christaller, 1933 and Losch, 1939) with its static and deterministic assumptions have been modified in view of homogeneity in socioeconomic regions (Brush, 1953; Janelle, 1968) and a deterministic hexagonal pattern of marketing or distance minimization (Berry and Garrison, 1958; Davies, 1967; and Rowley, 1971). The result is a revised central place theory that takes into account the causal factors that change the viability of central places of a region over any given period of study

(Bracey, 1956; Brush, 1953; Hodge, 1965; Smith, 1970) and allows for probabilistic implications (Murdie, 1965; Golledge, Rushton and Clark, 1966; Davies, 1969; Rushton, 1971; Burnett, 1973; Pacione, 1975; Williams, 1979; Brooker-Gross, 1981 and Hall, 1983). This theory has been developed to explain the impact of regional development and economic growth over time and the impact of individual peculiarities and choices of shopping behavior in changing the viability and spatial distribution of central functions or central places of a study area.

The hierarchical structure of central places (Berry and Garrison, 1958; Bracey, 1956, 1962; Hodge, 1965; Davies, 1967; O'Farrell, 1969; and Marshall, 1969) or their rank size relationships (Stafford, 1963; O'Farrell, 1969; Carter, Stafford and Gilbert, 1970; and Johansen and Fuguitt, 1979, 1984) are a significant component of classical and revised central place theory. The changes of hierarchical structure (Pahl, 1964: noted in Lewis, 1979 and McGranahan, 1980) and/or rank size relationships (Johansen and Fuguitt, 1979 and 1984) were hypothesized in the study area, did not negate the presence of hierarchical structure and rank size relationship of central villages at three points in the study time. Functional index data classing (Davies, 1967; O'Farrell, 1969; Marshall, 1969 and Bennison, 1978) was useful in determining and comparing the functional changes of the different classes and sizes of selected villages in a temporal framework. The threshold population for

selected central functions (Berry and Garrison, 1958; and Johansen and Fuguitt, 1984) at different points in time was determined to distinguish whether certain functions belonged to high or low order central villages.

The distribution of central villages in the study region and their interrelationships provides the spatial component of this study. Examination of their developmental patterns over certain periods of time (1950-1970 and 1970-1980) provides the temporal or dynamic aspects, and investigation of the shopping patterns and preferences of farm and nonfarm families, who live in areas surrounding the villages, provides the behavioral component of the study.

The Content Of The Chapters

Chapter One is devoted to reviewing classical central place theory and its revisions. This chapter is important in shaping the deductive hypotheses that appear in the second chapter.

In Chapter Two, the research design and procedure are presented. A statement of the problem, delineation of hypotheses in their theoretical and empirical dimensions, and an overview of the study area (46 central villages in south-central Michigan) and study time and period (1950, 1970, 1980: 1950-1970, 1970-1980) provide an introduction to this chapter. Data sources, methods of analysis, and the field

survey questionnaires are presented, as well as the rationale for selecting eighteen villages for field surveying and the rationale for selecting ten central functions that are inserted in the farm and nonfarm family questionnaires (thus providing behavioral interpretation to determine a humanistic range for a certain function). Maps, diagrams, tables, and graphs are described. A brief general outline provides the methodology used to classify the functional viability of central villages, the method used to measure the point pattern of spatial distribution of different classes of central villages classes (nearest neighbor analysis) and justification for using the chi-square test to cluster the factors influencing the selection of a certain good at a particular central place. The limitations and significance of the study are presented in concluding this chapter.

Chapter Three focuses on agricultural development (farm mechanization, specialization and consolidation) and transport development (rail, highway, and truck-oriented transportation) in 16 counties of southcentral Michigan. It also demonstrates how the consequences of rural development created specialized demand for modern agricultural technology, consistent with higher farm income, and demographic changes (due to rural development) in the spatial distribution of population in the study region over the study period. The increase of nonfarm population in non-metropolitan areas and farm depopulation in relation to rural

development in the region is explained. This chapter is a presentation of overall rural development in the study area over the study time. It provides essential data for Chapter Five which deals with changes in the viability and spatial distribution of central villages as a consequence of rural development.

Chapter Four deals with socioeconomic modeling of central villages in functional and structural presentations. To facilitate a comparative theoretical visualization of the functional viability of central villages, they have been classified in their hierarchical groupings for 1950, 1970, and 1980. This classification is useful in demonstrating the growth or decline of the classes of central villages. In explaining the structural models for these villages, continuous and discontinuous models (rank size rule and hierarchical grouping) have been used. These models are helpful in predicting the population required for a certain function or for a certain class of villages. Functional and structural modeling of central villages have been essential for explanations in Chapters Five and Six.

Chapter Five focuses on the viability and spatial distribution of central village classifications in 1950, 1970, and 1980. Explanations of the role of rural development in changing the functions of central villages and their frequency of distribution over the periods of 1950-1970 and 1970-1980 are provided. The disappearance of old functions

and the emergence of new rural functions in the central villages are discussed. The spatial distribution of different classes of central villages in regard to their standardized pattern (using nearest neighbor analysis) over the study time has been modeled and explained. Indeed, their relative location is discussed in relation to the network of super highways in the region.

Chapter Six explains the association between the hypothesized factors (subjectives, objectives, and individual characteristics) relative to farmers' and nonfarmers' selections of certain functions in a certain central place. Income, age, mobility, farm size, and types of farming...etc., are tabulated on the chi-square probability scale figures that resulted from this discussion. The shopping choice behavior of farmers and nonfarmers in the villages surveyed is representative of the range of each function in this region that is created by spatial choice behavior. This chapter shows the influence of individual preferences in changing the viability and spatial distribution of central villages and is helpful in identifying the patronization of central villages and their functions.

In Chapter Seven, the results of this research are reviewed to identify non-viable villages and the problems involved in their survival in competitive space. Viable central villages are also determined, along with their potential for polarization (economies of scale) of higher order

functions. In light of the research results, some speculations are made about the future development of the central villages studied.

An Introduction To Settlement Geography

Settlement studies are considered a part of human geography (Garner, 1968:303). Human geography, as a discipline, involves several subfields including economic, cultural, social, political, historical and urban geography (Broek and Webb, 1978:2). The study of human geography may be approached from two basic frameworks: a humanistic approach (man as the subject) that relates to subjective experience (with man as the active and determining factor) and a structural approach that is objective (with man as an object, a determined factor), and relates to social constraints (P. Jackson and S. Smith, 1984:8-12). Thus, it can be argued that among the subfields of human geography, cultural and social geography are structural or holistic (a passive approach, such as Sauer's cultural landscape studies) and economic geography with its behavioral aspects is interested in process and application (an active approach). Both have made important contributions to settlement geography.

As Jordan notes "settlement geography stands as a separate field within the discipline, on a plane with

population or economic geography." (1966:26). Therefore, settlement geography, like human geography, can be studied from a structural (objective) or an individualistic (subjective) standpoint. In rural settlement literature the two major trends are clearly distinguishable. One is made up of followers of von Thunen and Weber or contributors to location theory (positivism), with later revision in the light of behavioral geography.¹ The other approach is structural and is characteristic of the work of Meitzen (1895), Vidal (1926), Brunhes (1952) and Demangeon (1920, 1927), whose works have inspired and stimulated later settlement geography studies. Their major contributions to settlement geography discuss the historical, cultural, social, and economic components of rural settlements. In other words, they examine the origin (historical sequences of human occupation and expansion of rural settlements); form (morphological features of rural settlements, including architectural styles and distributional patterns of rural dwellings and farmsteads and land use patterns of fields and rural roads); and function (types of land use

¹ Spatial human behavior with its positivist foundations, and humanistic components is ranged against the structural approaches in social and cultural studies (Ley, 1981:249-257; Couclelis and Golledge, 1983:331-339).

and kinds of farming that represent rural agroeconomic activities) of rural settlements. These notions have stimulated later contributors such as Lefevre (1945), Sauer (1925, 1945), Kohn (1954), Stone (1965), and Clout (1972), whose studies are valuable sources of tradition in the ideas and methodology of modern and contemporary settlement geography.

Their idiographic methodologies and concepts, however, are mostly descriptive and difficult to apply in empirical studies. They are not formulated as theories that can aid analyses and explanations of places and processes and facts of settlements. In fact, the main core of the literature deals with the site of a settlement rather than its situation, i.e., its relative placement on a spatial plane with other settlements in a region.

In adopting an analytical ground for this study, it was thus necessary to consider the ideas of the contributors to location theory who were inspired by von Thunen and Weber. The theory was developed and reoriented by later contributors to the spatial view of human geography, as revised by use of the behavioral concepts.

Literature Review

Von Thunen's work (1826) stimulated contributors, such as Christaller and Losch, to study the functional

relationships between central places in regard to their relative location in competitive space. Von Thunen's assumptions deal with an "isolated state", with a competitive process between agricultural land-uses and their distance to a single market city available to farmers. Distance from the market is the most important factor influencing the land rents of agricultural lands and agricultural products (Thunen, 1826). "One essential characteristic of von Thunen's writing is the postulate of rational economic man, possessed of full and certain knowledge, seeking to maximize his income." (Chisholm, 1969:401) It should be explained that the factor of distance is not always equally important, because the development of transportation, variety in agricultural products for other competitive markets, and farmers' choices in various communities of the world may overshadow distance in importance. Thunen's concept of "economic man" is idealistic and deterministic because farmers' behavior cannot be optimized because of individual preferences (active view of human beings). However, his work is valuable for establishing the framework for the concept of relative location. Chisholm argues that, "the ideas developed and expounded by von Thunen do not constitute a theory of location," (Ibid, 1962:21) but they did stimulate the work of Weber, Christaller and Losch.

Foust and deSouza mention that, "classical location theory is founded on the work of Alfred Weber," that was

published in 1909 (Foust and deSouza, 1978:129). Weber's location theory is a modification of von Thunen's theory of rent (Barlowe, 1978:286). Weber's (1929) location theory concerns industrial planning and includes a model for determining optimum location for establishing new industrial plants. In it he indicates that geographical location, availability of resources, labor force and supply are vital elements in the location of industries and factories. Indeed, transportation development is vital for the development of regional industries. The industrial location theory of Weber is important because of its stimulating effects on Christaller (1933), Losch (1939), Hoover (1943),² and Isard (1950).³

In order to "make new paths for demonstrating the spatial effects of economic laws and rules on the geography of settlements," Christaller deductively derived central

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Hoover's 1943 work concerns the economics of industry location, land utilization, land use competition, urban structure and regional development. His emphasis is based on the optimum utilization of land, land rent, site value, processes of locational change, market location for regional development and locational stabilization. Hoover was influenced by Weber and Losch. His contribution to location theory is industrial rather than agricultural, so it is not appropriate for rural and agricultural studies.

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Isard (1950) has developed the location theory of Weber analytically in his system of input-output analysis (economies of scale). Isard's work deals with industrial and agro-industrial planning in a theoretical analysis toward overall development of a region. Isard was influenced by Weber and Losch. His contribution to location theory is most useful for urbanized areas.

place theory (1933) according to his inspiration from von Thunen and Weber (Berry and Harris, 1970:117). Christaller's work in southern Germany is most significant for its patterns of central places in a relative or competitive location, and their functional and economic relationships to surrounding areas. James notes that

The foci or nodes around which settlements tend to cluster are what Christaller called central places, each surrounded by a complementary area with which the central place is functionally related (1977:518).

Christaller (1933) arranged the central places of southern Germany in a hexagonal marketing pattern and classified the central places in hierarchical order from larger to smaller. This hierarchical order was arranged according to population size and centrality, with relatively few larger centers in a study area with greater ranges of goods and services and numerous smaller settlements in the region with lesser ranges of goods and services (Christaller, 1933).

Losch supported Christaller's triangular pattern of settlement distribution and hierarchical ordering of central places in their hexagonal patterns of marketing (Foust and deSouza, 1978:83; James, 1977:519; Haggett, Cliff, and Frey, 1977:98). He was doubtful of the existence of hierarchies, however, in his research on Iowa (Berry, Barnum and Tennant, 1962:102). Judging whether a hierarchy or a continuous relationship exists in the spatial distribution of

central places is difficult. Berry, Barnum and Tennant point out that, "Both continuous relationships and hierarchies, and blends thereof, may be produced from the same data and it therefore seems foolhardy to continue the argument as to which is valid. Both exist." (Ibid:103)

Losch's (1939) approach also differs from Christaller's in that he starts from the lower part of a central place system (farmstead) and moves to the higher order central place (metropolitan). In practical terms this would be extremely detailed, but could be applicable in empirical studies of relative location in a region of farmstead land uses and land rents. In fact, Losch's agglomerated system would be difficult to verify by empirical facts, while Christaller's agglomerated model is simpler and more applicable to empirical studies. (Foust and deSouza, 1978:83) Thus, Christaller's model is preferred for its simple spatial arrangement of central places in empirical studies.

Losch was primarily concerned with the future planning of optimal patterns of towns, firms and factories, rather than explaining their present situation. This is not useful from the point of view of some geographers, because they are concerned with human behavior and attitudes in existing regional developments, rather than purely deterministic locational planning. In a comparison of Losch and Christaller M.J. Webber (1971) points out that the idealistic and suggestive regional planning of Losch implies what town

patterns "ought" to be if reality were rational. In contrast, Christaller has explicitly applied his theory to explaining and predicting the actual patterns of towns (Webber, 1971:15).

Another peculiarity of Losch's (1939) central place theory is that it is concerned mostly with large regional systems, including urban and metropolitan areas, with urban, industrial, and manufacturing activities (macro-scale), while Christaller's (1933) theory deals with local systems of central places that are relatively micro-scale and concerned with retailing and service activities for the sparse agricultural people of the hinterlands around the central places. To be sure, both these concepts are valid and applicable for empirical study. For the purposes of this study, however, Christaller's theory of micro-scale regions with rural retail and service-oriented activities is preferred.

The ideas of Christaller and Losch are criticized for being static, not dynamic, and for being deterministic. Allen and Sanglier note that, "The developments of central place theory, although quite sophisticated, have been, in general, static." (Allen and Sanglier, 1979:256). Abler, Adams and Gould also believe that central place theory is not dynamic and does not show the processes of change in central places (Abler, Adams and Gould, 1971:377). It is called deterministic, because the probabilistic aspects of

consumers' behavior toward central places are not developed in the models of central place theory. Foust and deSouza mention that, "Formulations of Christaller and Losch...developed on the basis of classical economic theory, ignore nonoptimal consumer behavior." (Foust and deSouza, 1978:83) But Losch's concern for the subjectivity of farmers' choices of different goods and services is a helpful probabilistic perspective developed in later studies that has modified the rigid models of central place theory. Behavioral geographers, particularly, have overcome the deterministic problems of this theory. Approaching central places from a historical dimension (change over time) and including the probabilistic aspects of farmers' preferences and shopping behavior in adaptation of rural development are essential modifications in central place theory.

The theoretical central place work of Christaller and Losch inspired a whole school of human geographers in the United States during the 1950s (Gould, 1969:3). In the post-1960s period, "geographers rediscovered the classical economic theories of location hypothesized by Thunen, Weber, Christaller, and Losch." (Berry, Conkling and Ray, 1976:7). In fact, only during the last two decades has there been any rigorous testing of central place theory, although early research, largely involving rural communities and small towns in North America, tended to confirm the validity of this theory (Lewis, 1979:119). Central place theory with its

novel perspectives signaled the end of a period of stagnation and set the stage for an era of continued progress and intermittent conflict in geographic knowledge as well as theory (Muller-Willie, 1978:64). Among later contributors to settlement geography were those essentially influenced by central place theory and others influenced mainly by von Thunen's notion of competition between rural settlements (farmsteads). It should be noted that the work of Chisholm (1962) and Hudson (1969), which was influenced by von Thunen's land rent theory, Weber's location theory, and Christaller and Losch's central place theory, is modified primarily from perspectives that were concentrated on the relative location of farmsteads and farmers toward a central market (Chisholm, 1962) and the stages of change in the spatial distribution of farmsteads (Hudson, 1969). Generally, their approach concerned the locational factors of the social and economic life of farmsteads, rather than central places.

Chisholm's work (1962) is a systematic and conceptual approach that deals with the rural settlement's contents and subjects. His ideas of rural development essentially consider optimal planning for settlement patterns of farmsteads in the countryside, rather than focusing on central places. Chisholm, like von Thunen, emphasizes the locational factor of distance of farmers from a market in the central city for their agricultural products, but other markets in other

central places are not considered. Chisholm (1971) believes that with price competition in marketing, the consumers' (farmers) marketing behavior will be rational. It should be noted that price is only one attraction of central places for farmers and is not all-inclusive, because farmers' individual behavior is not the same. On the whole, Chisholm's work does not provide a theoretical model that would be easy to apply in empirical studies of rural settlements. Indeed, for the purposes of this research, which deals with the behavior and preferences of farmers toward central places, Chisholm's work was not as useful as revised central place theory studies and recent works of behavioral geographers.

Another contribution to the location theory of rural settlements was provided by Hudson (1969), whose work deals with rural settlement location theory and its application to the farm landscape of parts of eastern Iowa. Hudson believes that patterns of rural settlements will be changed over time. The notion that change is a dynamic process, is helpful; but a problem arises with Hudson's assumption of a biological model for the colonization of each settlement over time. Hudson believes theoretically in a niche space or biotop space of each settlement which will be expanded by human occupation (colonization) and also by increasing population density (spread). These models of biological processes of settlements create deterministic conditions for the settlements' processes of change over time, without considering non-optimal human preferences. Hudson's

biological assumption is severely criticized by Grossman (1971) and Lewis (1979). Grossman (1983) criticized the developmental stages of Hudson's theory and decided it would hardly coincide with real settlement patterns and their changes. Generally, Hudson's location theory does not deal with the spatial distribution of central places in the rural landscape, but only with the changes in cluster patterns of farmsteads toward a regular pattern. Therefore, apart from the biological aspects of his location theory, it is not useful for research that deals with patterns of spatial distribution of rural central places.

Components Of Central Place Theory

In the following discussion the essential components and attributes of central place theory are explained.

Uniformity

According to central place theory, unity and homogeneity in the physical environment and some aspects of economic and human uniformity in the study area (such as equal incomes of consumers) are required (Kariel and Kariel, 1972: 248). This assumption of economic and human uniformity in any given region of the developed world has been discarded by Berry and Garrison due to a demonstrated lack of homogeneity among consumers (Bunge, 1966:143), by Janelle in the

case of disuniformity in transportation factors (Janelle, 1968:5-10), and by Brush in the case of disuniformity of methods of transportation (Brush, 1953:400). Indeed, the assumption of uniform income of farmers or consumers as postulated by Christaller (1933) and Losch (1939) does not coincide with reality. Rural development and farmers' differential success in upgrading outputs, and consequently their income, has increased the diversity in their incomes.

Geometric Arrangements And The Concept Of Range

As mentioned before, both Christaller (1933) and Losch (1939) believed in triangular patterns of settlement distribution that central places with triangular lattice distribution are characterized by dispersed patterns and competitive processes in market space (Taylor, 1977:141). Their differences are apparent in the presentation of their models. Losch's (1939) marketing system is excessively complicated for empirical work, and more deterministic, which made it inappropriate for this research. Christaller's less complicated marketing system and its modifications were found to be more appropriate. According to Christaller's theory there is a progressive order of distance between central places; the next order range limit of central places will be computed by multiplication of its lower range limit by 1.732 when $K=3$ in the network of the

classical central place theory's marketing model (Christaller, 1933:63). Brush's case study in southwestern Wisconsin reveals a progressive order of hamlets, villages and towns that closely adheres to this rule of central place (Abler, Adams, and Gould, 1971:371). The rigid and deterministic hexagonal pattern of market system in original central place theory paved the way for modifications in later central place studies, such as Berry and Garrison (1958), Stafford (1963), Davies (1967), Kenyon (1967) and Rowley (1971). Alternative methods include nearest neighbor analysis, which enables dot patterns to be measured by an index (Garner, 1968:310). This method is in keeping with the predictions generally made on the basis of central place theory (Kariel and Kariel, 1972:262).

The concept of range is implied in the geometric patterns of central place theory. According to Christaller, "the range is the distance to which the dispersed population will still be willing to go to purchase a good offered at a central place." (Christaller, 1933:49,50) In Christaller's concept of range, the premise is "That consumers always patronize the nearest place which offers the required good." (Clark and Rushton, 1970:486) This, too, is not consistent with reality. Clark (1968) found in his empirical study that fewer than half of a sample of consumers were accustomed to traveling to the nearest center to shop, while others travelled much greater distances to larger centers

(Clark, 1968:386). Consumers' shopping habits do not conform strictly to a rule of distance minimization; other factors, such as the socioeconomic attributes of consumers and individual behavior, will also affect the range of a good or service in a central place system. In an empirical study, Murdie (1965) has shown that cultural differences between two social groups in Canada affect their travel behavior toward such goods as auto repairs, shoes and clothing. The figures provided clearly show differences in the preferences of these two groups of consumers toward central goods and services. In other words, the maximum range of goods and services is determined by different consumer preferences toward various goods and services. Similarly, Ray (1967) in his empirical study of the farmers of a bicultural community (French and English Canadians) in eastern Ontario, found that cultural differences were significant only in shopping for intermediate services, while different ranges of shopping travel for different functions were important in both cultural communities. Food stores had the smallest range of travel and optical services had the largest range of travel among both ethnic groups. The patterns of shopping were assumed to be the functional levels of central places. This method of visualization is probabilistic and preferable to the rigid marketing pattern visualizations of central place theory. Golledge, Rushton and Clark (1966), like Losch in 1939, found that consumers are biased in their

shopping travel (range of a good) for different goods. For spatially flexible goods, such as girls' clothing, consumers will often go to alternative centers, rather than the nearest occurrence of the good, before making a purchase (Golledge, Rushton and Clark, 1966:263). Certain spatially inflexible goods and services (such as church and T.V. repair) are not competitive, because people do not travel long distances, or a great range of distances, for these services (Ibid:264). Therefore, the subjectivity of consumer preferences affects various ranges of marketing space and invalidates the distance minimization concept of classical central place theory. In conclusion, shopping or visiting travel maps for different functions, are probabilistic and practical for use in this empirical research.

Hierarchy Or Rank Size Rule

The proposition of a hierarchical arrangement of service centers lies at the heart of central place theory (Davies, 1967:61). Hierarchy is a fundamental concept of system organization and interaction (Berry, Conkling and Ray, 1976:8). Christaller stressed that the basic functions of a city are ordered by centrality;⁴ such central

⁴ Centrality means "the relative importance of a place with regard to the region surrounding it, to the degree to which the town exercises central functions." (Foust and de-Souza, 1978:69).

places are ordered into an hierarchy comprised of discrete groups of centers--the greater the centrality of a place, the higher its order (Young, 1978:75). Indeed, higher order central places have greater population size. Central places were classified by Christaller (1933) according to their discrete levels of population. Christaller's hierarchical order of central places deals with aggregation of functions and tertiary activities (retail and services), while Losch's attention is focused on continuous attributes of functions in central places and their secondary activities, such as industry and manufacturing (Bell, Lieber, and Rushton, 1974:214). For the purposes of this research, which deals with the relationships between the preferences of farmers (people of the hinterland) and the functional importance of central villages' goods and services, the hierarchical concept of Christaller would be appropriate. However, because the small sample size for each class of central villages can cause difficulties in deriving results from correlation and regression tests, a continuous model that has a greater sample size (N=46 central villages) and stronger results will be applied in identifying population and function relationships in the study area.

Several contributors to central place theory have demonstrated the validity of the functional hierarchical class-system. For instance, Berry and Garrison (1958), Bracey (1956, 1962), Hodge (1965), Rowley (1971), Davies

(1967), O'Farrell (1969), and Marshall (1969) have strongly supported this assumption of central place theory. Fisher and Rushton (1979), in their study of regional planning in Indian villages, have applied the notion of a hierarchical order of rural services, which they call "functional integration of services." (Fisher and Rushton, 1979:84).

Rank size rule (population size of settlement and functional range) is another interpretation of hierarchical system. In order to classify central places in empirical studies hierarchically, the notion of a continuous relationship between population and functional range (maximum number of functions in each village) is taken into account. Stafford (1963) in his study of southern Illinois, found this relationship to be positive in a correlation and regression analysis ($r=.892$). O'Farrell (1969) in his study of Tipperary County (Ireland) found $r=.997$ in a continuous relationship of population and functions of settlement. In analysis of another area, Rowley (1971) found $r=.948$. Johansen and Fuguitt (1979, 1984) in their study of the United States' villages, worked on this continuous relationship and found $r=.80$ in 1950, $r=.82$ in 1960 and $r=.75$ in 1970. Carter, Stafford and Gilbert (1970) in their empirical study of Welsh towns, found a continuous relationship between population size and functional range, with $r=.87$. In a discontinuous model of the same data, it was $r=.81$ for places with less than 50 functions, $r=.59$ for

places with less than 20 functions, and $r=.47$ for places with less than 10 functions. These writers thus concluded that smaller central places are very sensitive to regional development and socioeconomic change (Carter, Stafford, and Gilbert, 1970:34). The great amount of correlation coefficients between the population size of settlements and their functional range in these continuous models, shows a strong association between these two variables in the previous empirical studies. It means that any changes in the population of a village is effective in the change of its functional range. In the case of discontinuous models, smaller correlation coefficients between population size and functional range of smaller central places, compared with larger ones, show that the population change of smaller central places is not strongly associated with change in their functional ranges.

According to King and Golledge, "threshold level is defined as the minimum level of support, as measured by numbers of population, required to support a function in a particular community." (King and Golledge, 1978:122) The required population for supporting a function in a central place varies with the type of function. For example, the threshold population (using a linear regression analysis) for "filling stations" was 196 persons (lowest order function); and 1,424 persons for "health practitioners" (highest order function) in Berry and Garrison's (1958) empirical study of Snohomish County. Johansen and Fuguitt (1984)

found the threshold population for "service stations" (lowest order function) equal to 305 in 1950 and 457 in 1970; for "photography studio" (highest order function) they found 1,453 persons in 1950 and 2,049 persons in 1979. It evolves that the threshold population increases over time and the continuous relationship between function and population is additional support for the rank size rule of central place theory. A continuous correlation between population size and functions of central places needs arbitrary divisions of functions that are usually done by the "natural breaks" methods, as in Bracey's (1962) and Kenyon's (1967) work. Such arbitrary division of functions is subjective and does not determine the hierarchical linkages between the functions of central places. The classification of functional agglomerative linkage, called "functional index," is more valuable because it is objective and focuses on the functional interrelationships between the central places of a region. The "functional index" was created by Davies (1967), who stimulated the work of Marshall (1969), O'Farrell (1969), and Bennison (1978). This model is also helpful for determining the rank order of each individual function, consistent with its coefficient value.

There is also an alternative continuous approach that considers discontinuities in relationships between population size and settlement functions. Berry, Barnum and Tenant (1962) and Ray (1967) have applied factor analysis in

their classifications of central places into hamlets, villages, towns and cities. The relationship between population size and functional range in each class is unconnected with other classes. Therefore, there is a discontinuous relationship between the population and function of the four discrete classes. This method also reveals the maximum range and threshold (minimum range) of each class. Visualizing the range and threshold of each class of central places is possible by using other classifications, including functional indexing. Because classes are determined by their functional viability, the related data of population could be used against the related functional ranges of central places. Indeed, computing the location coefficient is a complementary and preferable advantage of this method, compared with factor analysis.

Dynamic Orientation

In adopting a process-oriented and dynamic approach, the use of a historical approach is complementary. In analyzing changes in central places' functions, contributors to central place theory have identified several factors that have influenced the functional bases and viability of central places in their study areas. Christaller himself believed that effective demand for a good or a service depends on consumers' incomes and tastes. This led him to conclude that, "consumption of central place goods is

decisive in the development of central places." (Foust and deSouza, 1978:70). Bracey indicates that because of improvements in agricultural surpluses, the growth of industrial skills, and development of improved means of communication, rural services have been a part of regional growth (Bracey, 1956:50). Brush (1953), in his study of southern Wisconsin, found that economic and technological changes have been influential factors in the functional changes of central places. Smith (1970) described how technological innovation and adaptation in transportation and agriculture have shaped economic changes in the River Bend area (Minnesota).

To conclude, it is apparent that social and economic growth (in agricultural and industrial sectors), technological development, and improvements in transportation and communication have been major factors in changing the functions of central places. In opinions expressed by other geographers, particular factors are believed to influence the growth or decline of central places. For instance, Brush and Gauthier, Jr., (1968) found that, in the United States increasing income, decentralization of population and the use of automobiles seemed to be changing the patterns of settlements. In Lewis' opinion, the improved mobility of consumers and their increased wealth, with a concomitant demand for specialized goods and services influenced the growth and decline of central places (Lewis, 1979:137, 138).

Clawson (1966) notes when farmers' incomes increase, their demands for goods and services change. They may become unwilling to accept what they perceive as inferior goods and services offered to smaller central places (hamlets), and so will travel to larger centers (towns) that may offer better and more varied goods and services. These ideas seem appropriate and complement previously mentioned factors.

Hodge's empirical study (1965) of the trading centers of Saskatchewan, supports the impact of these factors on changes in settlement patterns and functional changes in trade centers. Hodge found that demographic, locational, economic and social factors caused essential changes in the viability of these trade centers over a short period of time (1941-1961). He determined that smaller trading centers had declined or disappeared while intermediate trading centers had grown up and entered the ranks of the larger trading centers. He predicted that future patterns in his study area would show more disappearing small trade centers (an increasingly dispersed pattern of small trade centers); and an increase of larger trade centers (a more clustered spatial distribution). Hodge's work is a dynamic and predictive analysis of interactions among seven different hierarchical classes of trade centers in a framework of time and space and his suggestions about the future reallocation of trade services in the study area are useful. Central place studies of this type need to be augmented by further study of the behavioral preferences of consumers. Like Hodge,

Johansen and Fuguitt (1973) found in their empirical study of Wisconsin villages that locational (interacting relationships between central places), technological and transportation factors were significant in changing the trade centers' viability over thirty-one years.

As discussed before, transportation factors are significant in the development of central places and are an important component of rural development.⁵ Christaller stressed the importance of means of transportation as mediators in the development of central places (1933:47). Losch (1939) determined that the consumers' distance from the market was significant in the marketing process. In regard to general transportation development, the ideas of Christaller are more realistic than those of Losch, who emphasized the factor of distance without taking into consideration advanced means of transportation.

Brush (1953), in his study of southwestern Wisconsin, indicates that the spatial patterns of agglomerated settlements there were due to the influence of transportation

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Rural development is considered here in agricultural and non-agricultural sectors. The latter includes the development of roads, educational services, rural electricity and rural health services, etc. (Yudelman, 1976:313). Among the non-agricultural components of rural development, road and highway development is considered crucial. James S. Burch, in a study of secondary road problems in North Carolina, found that many changes of rural areas were influenced by highway improvement (also noted by Garrison, Berry, Marble, Nystuen, and Morrill, 1959:12).

types and sites in the nineteenth century. The railroad function that was prevalent then has since been reduced; trains have been replaced by trucks and passenger cars and the original patterns of agglomerated settlements (central places), which had been influenced by the role of railroads are presently changing under the impact of modern transportation. Clawson found that the development of transportation factors and the drawing power of larger towns had decreased the former importance of smaller centers in rural areas of the United States.

When a farmer hauled any product to market by horse-drawn wagon, he was anxious to have that market point nearby. Hence, small hamlets often existed at rail-sidings. Today, the truck may take the same product 25, 50, 100, 200 or more miles to a more nearby central market, either eliminating rail haul completely or continuing it only from a larger town. There is less need, or no need at all, for formerly intermediate market points.

...the sad state of most small rural towns is dramatic evidence that most farmers find the drawing power of the larger towns relatively very powerful, many farmers drive past the small towns in order to stop in the larger ones. (Clawson, 1966:286,289).

Foust and deSouza also noted that, in the Middle West, the improvement of transportation (widespread use of automobiles and paved roads) after 1914, enabled consumers to bypass smaller centers and patronize the larger ones (Foust and deSouza, 1978:98). Stafford, in a related, empirical study (1963), considered the influence of the increasing

popularity of the automobile on the increase in numbers of gasoline filling stations and auto repair garages in small towns. In fact, changes in transportation have fostered extensive changes in the form, functions and viability of central places over time.

Janelle (1968) and Smith (1970) have indicated the role of speed in reducing trip time between central places. When central places can be reached more quickly than was formerly possible due to technological development, the factor of distance is subordinated by increase in speed and reduction of travel time. Smith believes that such reductions of travel time and increases in income encourage consumers toward larger and further central places, causing the growth of larger centers and the decline of smaller ones. Abler, Adams and Gould (1971) also discussed the impact of time-space convergence and the increased income of farmer-consumers on their relationships with central places.

Today, because of the time-space convergence due to automobiles and good rural roads, a farmer can visit the sixth-order village center more easily than his grandfather could get to the nearest hamlet. He also has more money to spend and larger shopping lists. Many of yesterday's sixth-order goods and services have become today's everyday needs. The result has been the steady decline of the hamlets as a central place (Abler, Adams and Gould, 1971:369).

Johansen and Fuguitt (1979) in their research on villages of the United States found that rural people's greater mobility has been influential in the decline of the economic

viability of villages in the urban/rural system over the period of 1950 to 1970 (Johansen and Fuguitt, 1979:25). They also found that the viability of central villages is dependent on their retail sections; thus, the viability of those villages is altered by changes in farmers' shopping patterns over time (Johansen and Fuguitt: 1973, 1979).

The development of transport technology has enhanced the rural areas for commuters, retired people, and recreational seekers. Hart, Salisbury and Smith (1968:345) believe that cheaper housing costs in the villages of the U.S. make them attractive for low-income families who have their jobs in the cities. Wheeler (1971:110-119) states that rural nonfarm population in the U.S. partly includes the urban to rural migrants who prefer rural living and city employment. He explains the situation by the increase of geographical mobility of labor in the U.S. over the past decades. Johansen and Fuguitt (1973) found that the impact of automobile technology and road development in Wisconsin has attracted new residents for the recreational advantages in villages and their surrounding areas. This has caused some functional changes in the retail sections of the villages. In the 1970s, retirement and recreation emerged as important growth-inducing activities in the nonmetropolitan areas of the United States (McCarthy and Morrison, 1977: 140). Thus, there has been a great increase in the demographic growth of some rural areas (Long and DeAre, 1983:

41). McCarthy and Morrison (1977) mention that the migration to the United State's rural areas is due to the advances of transportation technology and the increased importance of natural emenities. Hodge and Whitby (1981) similarly believe the increased demand for leisure activities and improvement of transport facilities among the developed nations, have increased their rural populations. It may be expected that these demographic changes have had an impact on the central functions of villages. Falk (1980) in his empirical study of a Swedish city (Norrkoping) found a large reduction in the number of stores in the downtown area over 25 years. This was due to residential development in areas surrounding the city that required new stores and shows that demographic changes will influence the diffusion of stores and consequently the viability of cities and villages. Johansen and Fuguitt (1979) have found the changing patterns of population distribution to be one of the important factors in changing the viability of retail activities in U.S. villages. As a result, improvements in transportation and the increased mobility of people are encouraging change in the demographic patterns of rural areas of the developed world, including the U.S. Indeed, the change of demographic patterns itself has been responsible for changing the viability of rural American villages.

In conclusion, therefore, technological improvements have influenced the development of means and networks of

transportation and made central places more accessible to farmers than in the past. Indeed, the adaptation of technological improvements has upgraded the wealth of farmers and wealthier, more mobile farmers have shifted their shopping patterns from smaller centers toward more remote central places with more complex and specialized functions. Christaller believed there is a definite connection between the consumption of central goods and the development of central places (Christaller, 1933:27). Losch (1939) also notes the consumers' role in affecting functional and distributional patterns of goods and services in central places. Considering these ideas and the aforementioned empirical studies, the influence of farmers' increased incomes and demands (due to rural and agricultural development) on the viability and spatial distribution of central places has been fairly well established.

The increase of consumers' income and mobility takes place over a period of time and their impact on central place development or decline implies a time dimension. Therefore, contributors to revised central place theory have specified time frames for their approaches to functional change in central places. Hodge's (1965) study focuses on the changes in a trade center system from 1941 to 1961; Smith's (1970) study concerns an approach to agricultural and economic development in a region, including its central places, from 1900 to 1960; Kenyon's (1967) work on the

central places of Georgia provides a cross-sectional study of changes in the social and economic activities of central places from 1950 to 1960; and finally, Johansen and Fuguitt's (1973) research on the changes in retail activities (functions) occurring in Wisconsin villages includes the period from 1939 to 1970, with an emphasis on 1954 when these retail functions began to decline. Taken together, these investigations of functional changes in central places over time have focused on varying time periods of 10, 20, 30 and 60 years. After examining each scholar's rationale for the time period selected, neither extreme seemed overwhelmingly advantageous; the average and median of these cross-sectional studies suggested that 25 to 30 years would be an appropriate time period for the study at hand.⁶

Consumers' Shopping Behavior

Applying central place theory in an empirical study that examines the changes in rural retail centers and rural services, in relationship to the preferences of farmers or consumers (people who live in the complementary region or hinterland of each central place), necessarily involves consideration of the behavior of consumers. Spatialism is

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Norling, in research on the abandonment of rural settlements in northern Sweden, has used 30 years as his study period (1960:232-243).

criticized when it ignores the social questions (Taaffe, 1974). A behavioral approach as a complementary view in spatial analyses modifies the determinism of positivistic studies (Ley, 1981:250). Entrikin (1976) verifies the need in scientific geography for a body of empirical studies and their verified conclusions based on historical and regional geography and positivistic orientations of spatial and behavioral analysis.

According to central place theory, there are predictable minimum and maximum distances that consumers will travel to and from central places for shopping and services. This assumption is deterministic and cannot be generalized.

Central place theory is a model which helps us to better understand and predict spatial patterns of consumer behavior. We must keep in mind that human beings are not economic optimizers, but do, to a limited extent, adhere to the principle of distance minimization. (Foust and deSouza, 1978: 61)

Blommestein, Nijkamp and Veenendaal mention that central place theory assumptions of shopping models do not allow for the socio-psychological elements of consumer behavior, such as their perceptions and preferences (Blommestein, Nijkamp and Veenendaal, 1980:160). Therefore, the preferences of farmers need to be examined from the point of view of behavioral modifications to central place theory.

In the early 1960s, behavioral approaches tended to focus on environmental perceptions and decision-making processes and the concept of "economic man". Wolpert's (1964) definition of "economic man" is concerned with individual decision-making in economic activities and occupations.

As a rational being, "economic man" is free from the multiplicity of goals and imperfect knowledge which introduce complexity into our own decision behavior. Economic man has a single profit goal, omniscient powers of perception, reasoning, and computation, and is blessed with perfect predictive abilities...economic man organizes himself and his activities in space so as to optimize utility. (1964:537)

Adjusting and comparing the spatial and economic behavior of farmer-consumers with the model of economic man is not a reasonable and practical approach, because the various characteristics and preferences of individuals are different. Indeed, preferences in economic activities cannot be optimized to fit an ideal model that assumes all people perform their economic activities optimally.

In the late 1960s, behavioral studies began to appear which looked at spatial behavior, shopping behavior, and consumer behavior toward markets or central places. Economic and psychological models and shopping behavior models formed the analytical framework of this period. According to Golledge, Brown and Williamson, behavioral studies in this period were preoccupied with consumer travel behavior and re-examinations of central place theory (Golledge, Brown

and Williamson, 1972:61). Murdie (1965), in his cross-sectional study of "cultural differences in consumer travel," compares the shopping travel behavior of two cultural and social groups, an old order Mennonite group and a group of "modern" Canadians in southwestern Ontario (Canada). He found that these two groups have some differences and some similarities in their shopping behavior toward selected goods and services.⁷ Their range of shopping travel for goods and services was different and related to their subjective view of shopping in relation to spatial distribution of goods and services in certain central places. Another point was that the modern Canadians, who have adopted new technology, were more mobile and richer than the Mennonites, so the modern group made a greater range of shopping trips than the Mennonites. This study was concerned with choice behavior in an analytical process-oriented framework. The concept of choice or selection in shopping for a particular good or particular service is examined by Golledge, Rushton and Clark (1966) who studied the farm population of Iowa. They found that farmers were willing to travel longer distances, from the nearest occurrence, for particular (flexible) goods and services such as clothing and movies, while they were not willing to travel

⁷ In Murdie (1965:215), food, clothing, shoes, appliances, banking, auto repair or harness repair, doctor and dentist are shopping and convenience goods and services.

far and would stop at the nearest purveyor for inflexible goods and services, such as church services and appliance repairs. Thus, inflexible rural goods and services did not exert competitive power, in terms of farmers' choices and selections. It can be concluded that the behavioral preferences of farmers, in seeking goods or services, affect the pattern and frequency distribution of goods and services in central places. The approach of Golledge, Rushton and Clark (1966) concerning the biased travel behavior of shopping for different goods is process-oriented and analytical.

Golledge and Brown (1967) have studied the processes of search and learning in consumers' behavior toward marketing. They found that an individual consumer first exerts search or exploratory behavior toward markets, which is continued until minimum distance and maximum aesthetic value are attained. He will therefore respond habitually toward the market experience. "In terms of the market decision process, habitual responses may include the patronage of one or many market centers." (1967:117). Thus, learning and trial behavior are important in establishing habitual and stable shopping behavior. This type of study was found to be applicable in examining the habitual shopping behavior that study subjects directed toward central places. In fact, length of residency was found to be a factor which affected

the perceptions and choices of consumers and had an impact on marketing patterns.

Other peculiarities of consumer shopping behavior are age, income-level, socioeconomic condition and accessibility to central places. For example, Ross L. Davies (1969) has compared and analyzed the shopping movements of two income groups from Middleton (low income) and Street Lane (high income) in the south of Leeds (England), toward selected goods and services such as groceries, hardware, shoe repairs, bank services. He selected his subjects from groups of similar age and ethnic-racial composition, but differing income levels and his results indicated significant shopping preference differences, according to income level. The majority of low income people patronized chain stores and general stores while the high income people preferred to shop in smaller and more specialized stores (Davies, 1969:120).

The individual choice behavioral approach of the late 1960s continued to be employed in related studies undertaken in the early 1970s (Hudson, 1980:347). In the 1970s, however, psychological approaches began to appear in behavioral studies of shopping patterns, especially the application of personality and cognitive maps as correlates of spatial choice (Brooker-Gross, 1981:28). Cadwallader, in 1975, mentions that there had been recent efforts made to explain individual behavior in space, especially individual

decision-making. Meanwhile, the unsatisfactory concept of "economic man" was gradually replaced by the idea of satisfactory behavior and bounded rationality (Cadwallader, 1975:339). Finally, disaggregate behavioral research, based on the motives and attitudes of individual spatial choice, became typical of geographical studies in the 1970s (Blommestein, Nijkamp and Veenendaal, 1980:155).

At the beginning of the 1970s, when behavioral approaches were popular in central place studies, Rushton (1971:140) expressed the view that, "a revised central place theory, constructed on more realistic behavioral foundations, yields some spatial properties that are markedly different from those of classical theory." He believed that distance and site attraction are variables which influence shopping behavior in the spatial choice process (Ibid:141). Burnett (1973) disagreed that the objectives of distance, town size, convenience of parking, quality of goods, and prices of goods were necessarily the actual components of consumer choice and believed time and money to be the subjective alloys. She found that such factors as age and length of residency in a place influenced purchasers' choices from women's wear shops. Therefore, people, as a result of their experiences, are biased in choosing a shopping center. While it is reasonable that the subjective experiences of consumers influence their choices, locational aspects, such as town size, its attractiveness, and

the price and varieties of flexible or inflexible goods should not be ignored in analyzing shopping choice behavior. The concept of objective and subjective relationships in individual behavior is supported by Pacione (1982).

Shopping behavior was also examined through consumer perceptions and decisions made in choosing shopping centers or markets. Pacione (1975), in an empirical study, found that consumers did not actually behave in accord with the rationale of "economic man", but that individuals made decisions within the framework of their own perceptions of the retail environment. Individuals try to maximize their shopping satisfactions (consumer preferences) through their environmental perceptions (cognitive) of shopping centers (1975:84,86,91). Cadwallader (1975) examined the shopping preferences of a sample of lower-middle class families in West Los Angeles toward five adjoining supermarkets. He suggested that the link between an individual's perception (image) of an environment and his overt behavior (preferences) in that environment, are very important in the behavioral approach. His approach is helpful in socio-psychological analysis of individual's shopping (choice) behaviors.

In his 1979 empirical study, Williams examined three overt behavior variables in a sample of 500 grocery shoppers in southwest Birmingham (mode of travel, frequency of trip, and size of center used). He found that grocery shoppers

tend to prefer shopping convenience over the range of choice and price competitiveness that are available in larger centers. Therefore, they use centers near their homes and variations in distance traveled are low (Williams, 1979:160). Williams' data analysis of shoppers' differential values and preferences toward shopping centers, an inferential chi-square probability test, is reasonable and a probabilistic approach to behavioral preferences. Taylor (1979) in his empirical study of individuals' retail choices (personal dispositions) in Vancouver, has examined the consumers' dispositions toward five selected characteristics of retail shops: fashion orientation, price orientation, quality orientation, convenience orientation, and status orientation. In his approach, Taylor tried to examine the personalities and perceptions of individual consumers toward these five factors by using an environmental response inventory scale. He found which factor or factors had been more or less impressive (affected personal disposition) to the consumers sampled. This type of research looked at the personal dispositions (shopping choices) of consumers more objectively than subjectively, which is useful but not complete, because both subjective and objective factors contribute to consumers' choice behavior.

An evaluation of the behavioral studies in the 1970s shows that there has been a modification of the concept of

central place theory by developing and applying the behavioral perceptions and preferences of individuals in an analytical framework. Most studies concentrate on analysis of consumers' shopping travel patterns, indicating that attractivity factors of retail centers, such as location and size of town, convenience of shopping, and price and quality of goods, are objective aspects of individuals' preferences. In contrast, time, budget, age, income, and the experiences of individuals are subjective factors in their choice behavior.⁸ Both subjective and objective aspects are important.

The behavioral studies of the early 1980s continued to stress disaggregate and individual behavior attitudes and preferences, although some studies were done on aggregate preferences that considered both consumers' and producers' shopping choice behavior. Blommestein, Nijkamp and Veenendaal (1980), in their empirical analysis of integrated shopping factors in a Dutch town, examined the shopping images of both consumers and producers. Factors such as accessibility and price (objective factors), consumers' age, sex, average income, and frequency of shopping (subjective

⁸The grouping of factors into subjective and objective is based on the literature discussed in this research that describes subjective and objective behavior of consumers. If an individual is attracted to shop in a place because of the price of goods, it is an objective factor; conversely if an individual seeks a particular shopping center to save money, it is a subjective preference.

and personal factors) were examined in a comprehensive effort to explain shopping models. In a different study, Brooker-Gross (1981) examined two social groups' models of inshopping and outshopping for shoes and found that dissatisfaction with local opportunities caused outshopping by both groups. The groups, however, differed in their outshopping and inshopping behavior. Hall (1983) showed that race and age, as well as income, were factors in explaining shopping patterns for inferior types of food.

To sum up this discussion of shopping behavior analysis, Pipkin's evaluation is appropriate. Pipkin believes that the, "consumer-theoretic account of shopping behavior" implied in central place theory, has been linked with the reformulations of, "the late nineteen sixties and with more recent and overtly psychological accounts of store choice," (Pipkin, 1981:315). Further examples are provided in studies of spatial choices of shoppers at women's wear stores (Burnett, 1973); shoe stores (Brooker-Gross, 1981); grocery stores (Louviere, 1981); and food stores (Hall, 1983). These recent studies of consumer preferences show that each good and service in a central place has its own attributes and attractiveness that will affect the travel and choice behavior of shoppers. Integrated with each individual's peculiarities and preferences, these objective and subjective attributes of consumers' modal choices affect the viability and pattern of spatial distribution of

central places. Criticisms of behavioral studies of human preferences (Bunting and Guelke: 1979) should be disregarded because explanations of individual spatial preferences are analytical rather than deterministic applications of a holistic approach (See: Rushton, 1979; Saarinen, 1979; Downs, 1979; Duncan, 1981; and Couclelis and Golledge, 1983).

CHAPTER TWO

PROBLEM AND RESEARCH DESIGN

Problem Statement

The central villages of southcentral Michigan, with different size populations and functions, have seen varied changes in their viability and spatial distribution over the past thirty years. Central villages are trading centers for farmers who are the main consumers of their goods and services.⁹ Therefore, the relationships between the farmers and central villages include their trade functions (retail activities) and services.

This study focuses on identification and investigation of farmers' preferences toward central villages' retail, wholesale, and service activities in accord with revised central place theory. Correspondingly, agricultural and rural development influences on central villages' changes in viability and spatial distribution are examined and explained.

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In preliminary research (1982) on the villages of Fowler, Sunfield and Webberville, 80 percent of the people in the surrounding villages were farmers. During the data collection phase of this research in 1983, only 65 percent were found to be farmers.

Rural development in farming activity in the study region over the past thirty years has included the increasing percentage of farms equipped with tractors and a corresponding decrease in the percentage of farms having horses. Increased farm size, farm specialization and consolidation and increased farm efficiency have caused farmers' income to increase. Consequent to rural farming development, some central village retail, wholesale and service functions have expanded, such as florists, sporting goods stores, family clothing stores, farming equipment stores, banks and churches. Conversely, other functions such as grocery stores, gasoline stations and jewelry stores have declined dramatically, due to the loss of their viability. Some other functions and services of smaller villages have declined, such as schools and funeral homes, and have been consolidated in larger central villages. Several outmoded functions, such as blacksmithing, shoe repair and general stores, have almost disappeared from the rural landscape.

Accordingly, numbers and types of functions have undergone diverse changes in the central villages over the study period. It needed to be determined how many central villages (with different functional orders) had developed, stabilized or declined in the system. The factors that had caused these changes also needed to be identified. As indicated in the first chapter, rural development and farmers'

preferences were expected to be major influences in changing the viability and spatial distributions of central villages.

Hypotheses

Concerning Hierarchical Structures Of Central Villages And Their Change Over Time

From the evidence offered by Berry and Garrison (1958), Bracey (1956, 1962), Davies (1967), and Marshall (1969) of the hierarchical structures of central places in the developed world, it was expected that a hierarchical structure would be found among the functional bases of the central villages of the study area. But, because of the increase in the number of functions that are singular in their frequency of occurrence (with high location coefficients) in every class of central villages, it is likely that hierarchical structures of central villages have changed over the study periods. Pahl, in his empirical study of rural Hertfordshire in 1964, concluded that a change from hierarchical to segregated structure (expanding of functions horizontally) is one of the important aspects of a metropolitan fringe (Lewis, 1979:139). Similarly, McGranahan (1980:92) states that because of the decline in agriculture, farm depopulation and new rural activities for nonfarm families, the hierarchical structure of farm-oriented functions is changing. It may be predicted that the hierarchical structure of the central villages studied has likewise been

changed over the study time, due to rural development and the increase of nonfarm population in the study area.

Concerning Relationships Between The Population
Sizes Of Villages And Their Functions

There is a continuous relationship between the population size (or population served) in the central villages and their functional ranges (number of functions). Stafford (1963) found the coefficient of correlation equal to .89 in southern Illinois and Johansen and Fuguitt (1973) found $r=.87$ in 1954 and $r=.82$ in 1970 in their empirical study of Wisconsin, showing that the regression lines from 1954 to 1970 had shifted downward. The same trend was noted in later studies of American villages by Johansen and Fuguitt (1979, 1984). They found $r=.80$ in 1950 and $r=.75$ in 1970, with the regression curves shifted downward. Therefore, it was hypothesized that a continuous relationship between the population of the villages in this study and their functional ranges existed and was weakened over time, due to increased population (development of residential functions in the central villages) and declines in the number of tertiary activities (wholesale, retail and services). This situation implies a significant decline in the functional viability of central villages.

Assuming the existence of a hierarchy in the functional order of central villages does not undermine the above

mentioned continuous relationships between population and functions in the central villages studied. As Berry, Barnum and Tennant (1962:103) found, both hierarchical (discontinuous) and continuous models could be created from the same data. Therefore, examining both continuous and hierarchical structures of central villages is not a contradictory procedure in this research. It was, therefore, expected that a maximum functional range (maximum number of functions in each class of villages) and threshold population would exist for each class of central villages (for related literature see Berry, Barnum and Tennant, 1962; Carter, Stafford and Gilbert, 1970).

Concerning The Range Of Functions

Later contributors to central place theory found that consumers do travel differently for different goods and services. In other words, shorter trips are made for lower order functions and longer trips for higher order goods and services (Murdie, 1965; Golledge, Rushton and Clark, 1966; Ray, 1967; Davies, 1969; and Clark and Rushton, 1970). Therefore, it is hypothesized that the farm and non-farm families of the study area who live in the areas surrounding the central villages will show different patterns of travel for shopping. Thus, the range of each sampled function will be different and dependent on the shopping and

travel behavior of the consumers (rural farm and nonfarm families).

Concerning Rural Development

Adoption of technological and agricultural innovations (farm mechanization, specialization, and consolidation), has upgraded farm efficiency, production and farmers' incomes, so that farmers have increased their demands for more specialized and modern goods and services (consistent with their modern agricultural instruments, tractors, and manufactured tools) and decreased their demands for older and outmoded rural village functions.

Hart and Salisbury and Smith, Jr., (1968:345) note that most of the villages of the Middle West that had similar central functions in the horse and buggy era, lost these central functions due to the advent of the automobile. Johansen and Fuguitt (1973) found that Wisconsin villages lost several of their central functions, which had formerly been responsive to the outmoded agricultural technology, over time. In their places they gained new functions that were demanded by the new lifestyles of the people in the areas surrounding those villages. Similarly, it is hypothesized that the farmers of the study area, due to adoption of technological and agricultural innovations, do not demand outmoded functions that were locally available to them in the central villages in the past; instead they

demand advanced functions (responsive to business-oriented farming operations) that are supplied in the larger central places of the study region. It is anticipated that this re-orientation has changed the viability and spatial distribution of the central villages of the study area over the study period.

Transportation developments in the region have favored the adoption of modern trucks by farmers who use them to deliver their own products and make trips to central places. Indeed, street and road development in the central villages that has been accompanied by highway development in the surrounding townships, has enhanced farmers' mobility so that they bypass the lower order central villages and do their shopping in higher order central places, causing an increase in the centrality of larger villages and bigger central places and decreased centrality in smaller ones, due to competition. Moreover, the impact of transportation development encourages a dormitory function in central villages and their hinterlands, where nonfarm people reside on the farm landscape, work primarily in the urban centers and do their major shopping in the larger central places. Thus, villages high in the hierarchy, with adequate population to support their high order functions, have become more eligible for socioeconomic growth compared with the lower order villages of the study area over the study period.

Concerning The Order Of The Functional
Viability Of Central Villages

According to the earnings data from Dun And Bradstreet Reference Books, (Tables A.1, A.2 and A.3) the central village of the study area have seen severe reductions in the numbers of their retail functions over the past thirty years. It may be expected that the lower order central villages have lost more of their retail viability than the higher order ones. Robertson (1983) found that the reduction of retail functions in smaller American cities had been more rapid than in the larger central places over the period of 1954 to 1977. Johansen and Fuguitt (1984:202), in their study of American villages found that in a process of functional change from 1950 to 1970, larger villages gained at a higher rate and had lower rates of loss than did places of smaller functional size. Bunce (1983:18) states that when economic development occurs the smaller centers cannot compete successfully with larger ones. Similarly, Clout (1978:507) notes how the retail outlets have gradually disappeared from smaller villages in favor of larger settlements in a sample study of East Anglia. Thus, it is expected that the lower order central villages have been more sensitive to development and lost more of their functional viability compared with higher order central villages. The application of economies of scale will be meaningful here.

Concerning Farmers' Preferences

Farmers' range of shopping travel is related to the type and spatial flexibility of each particular function. Therefore, farmers do not always shop in the nearest center, their shopping travel for certain goods and services is biased. For example, gasoline stations exist in most of the central villages; they are low threshold functions. Men's and boys' clothing stores as a high threshold function serve a larger range of consumers' shopping model, so these two goods will be treated differently by farmers. Therefore, it is anticipated that farmers will favor larger central places in their shopping behavior and tend to bypass the smaller centers.

Farmers' individual characteristics and preferences (overt behavior or observable personality) toward their environment will affect their decision-making in shopping choices and shopping travel for particular goods or services (e.g., age, education, income, average farm size, type of land use, full-time or part-time farming, frequency of visits to a central place). Therefore, it would be expected that these different characteristics and behavioral attributes of farmers will differentially influence their choice of shopping travel for a certain good. In other words, there will be different degrees of association between farmers' characteristics and preferences and their choice of a central village for a certain type of good or service. It may be hypothesized, then, that farmers'

individual characteristics and preferences influence the viability and spatial distributions of central villages.

Farmers' shopping experiences with the goods and services available in central villages, will also affect their choice of shopping locations. Therefore, length of residency in a given place will influence farmers' shopping choice behavior and affect their selection or rejection of certain goods in certain central villages.

Attractiveness, competing prices of goods, accessibility and size of centers are objective attributes of rural goods and services in central villages that can encourage or discourage farmers' decisions to shop in those centers. It can be expected that higher order central villages and larger central places will be patronized because of the attraction of their competitive goods and services and their accessibility resulting from regional development.

An hypothesis that is concerned with the preferences of nonfarm families toward central villages is also proposed. It is hypothesized that nonfarm families, like farmers, make their decisions for shopping travel independently and use their experience subjectively in choosing to shop in a particular center. They may also be attracted to a shopping place by its price advantages (an objective behavior). The nonfarm family questionnaire serves to determine how such choices are made.

Concerning Time Frame

Because of significant changes in farming technology and transportation development in the study area over the period of 1950-1970, it is hypothesized that the most important changes in the viability of central villages have occurred during this period, because several functions in retail and wholesale trade have become outmoded and disappeared, while several new and modern functions have emerged. Therefore, it is expected that the spatial distribution of the central villages studied has been changed due to changes in their viability over the study periods and shows greater differences for the 1950-1970 period, than for the 1970-1980 period (because of greater change in their viability in the first period of the study).

Procedures

Study Area and Study Time

To test the hypotheses presented in Chapter Two, south-central Michigan, an area which is characterized by dairy and general farming (Figure 2.1), was selected. This region at the present time is typified by dairy and general farming with increased part-time farming throughout the region.

The area includes the counties of Ionia, Clinton, Shiawassee, Eaton, Ingham, Livingston, Jackson and major parts of Washtenaw. Indeed, small portions of Montcalm,

Types of Farming Areas

MICHIGAN

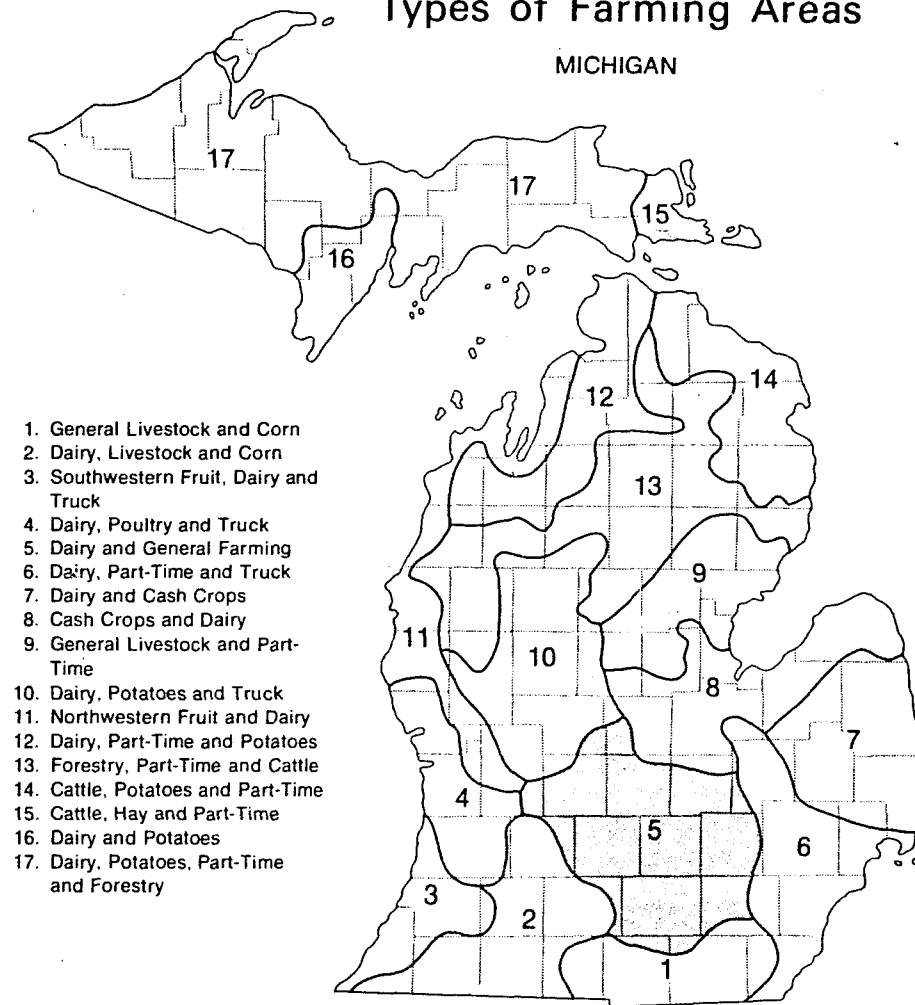


Fig. 2.1 Adapted from Hill and Russell, "Types of Farming in Michigan", in *Readings in the Geography of Michigan*, 1964, p. 182.

Gratiot, Kent, Barry, Calhoun, Hillsdale, Lenawee and Genesee counties are located in the region selected (Figure 2.2). The region selected is a region of homogeneous farming types in Michigan and is typical from the point of view of topographic conditions, climate and general economy. The flatness of the region encourages agricultural activities, including crops, cash crops and animal husbandry. Drainage has improved the quality of swampy areas and in general the region is a favorable place for agriculture. The cities of Lansing and East Lansing are located near the center of the study area, while the central villages are located throughout the area.

There are 46 such central villages in the region (Figure 2.3, 2.4) that range in population from 155 to 3,816 with a mean of 1,019 persons (Table 2.1), thus providing considerable variation in central village population sizes. To determine the normality of distribution of populations below, at or above the mean value, a Z score test was used to standardize the data. The Z values are shown in Table 2.1. Dividing the Z scale of those observations into three equal parts (33.3 percent of probabilities) at the points of $-.43$ to $+.43$ Z values distributes the data into three zones. Z-values before $-.43$ are below the mean, from $-.43$ to $+.43$ they are around the mean and beyond $+.43$ they lie above the mean. As a result, 48 percent of the population of Z-values are distributed in the zone below the mean, 26 percent around

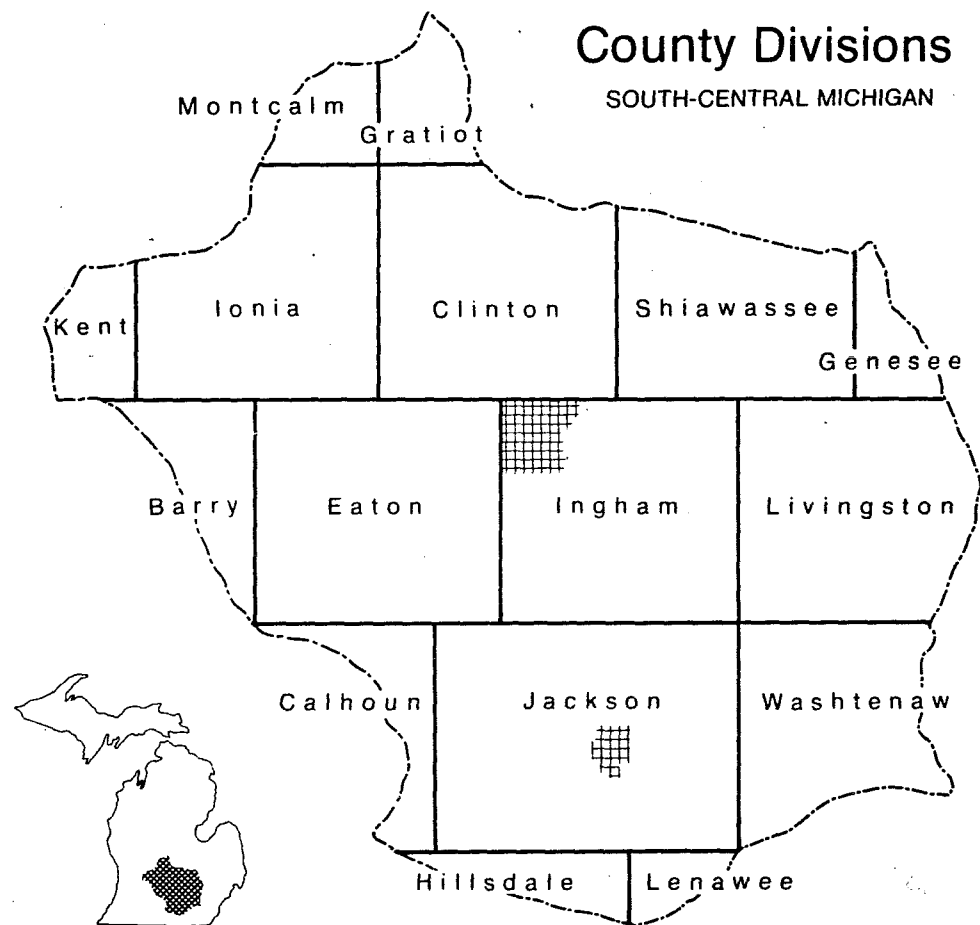


Fig. 2.2 County divisions in the study area.

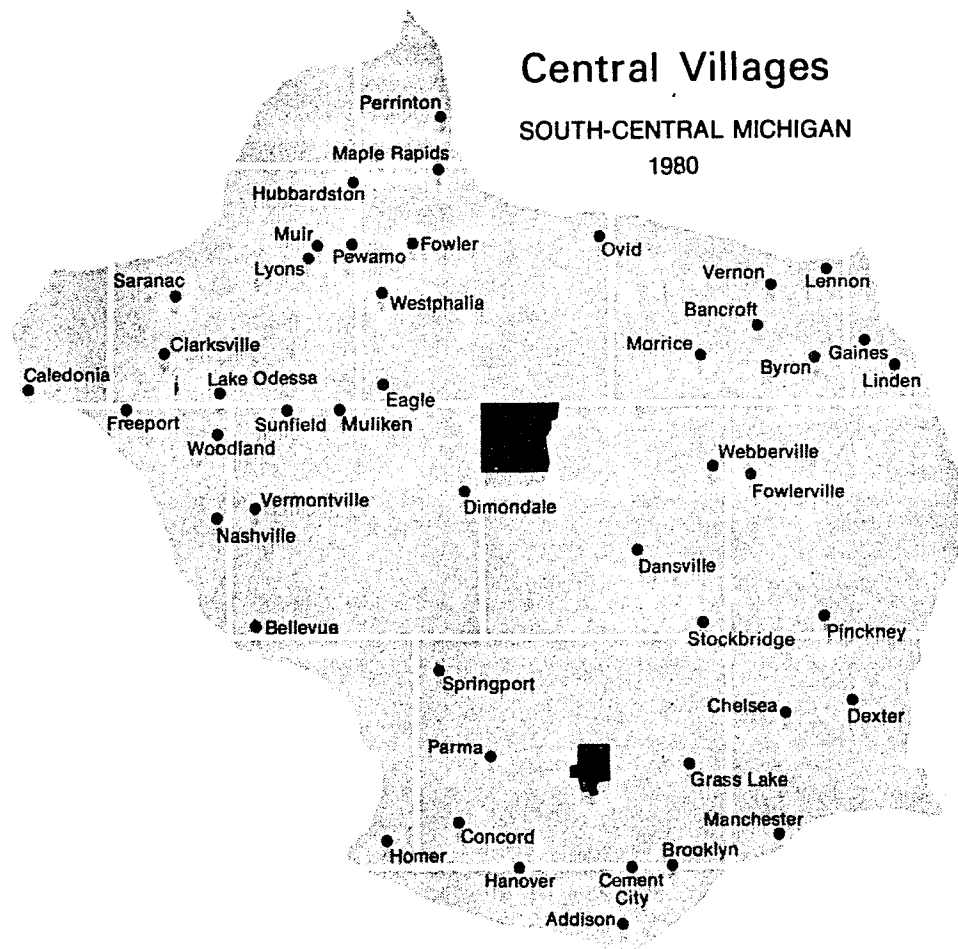


Fig. 2.3 Relative location of central villages of South-central Michigan on the county division patterns, 1980.

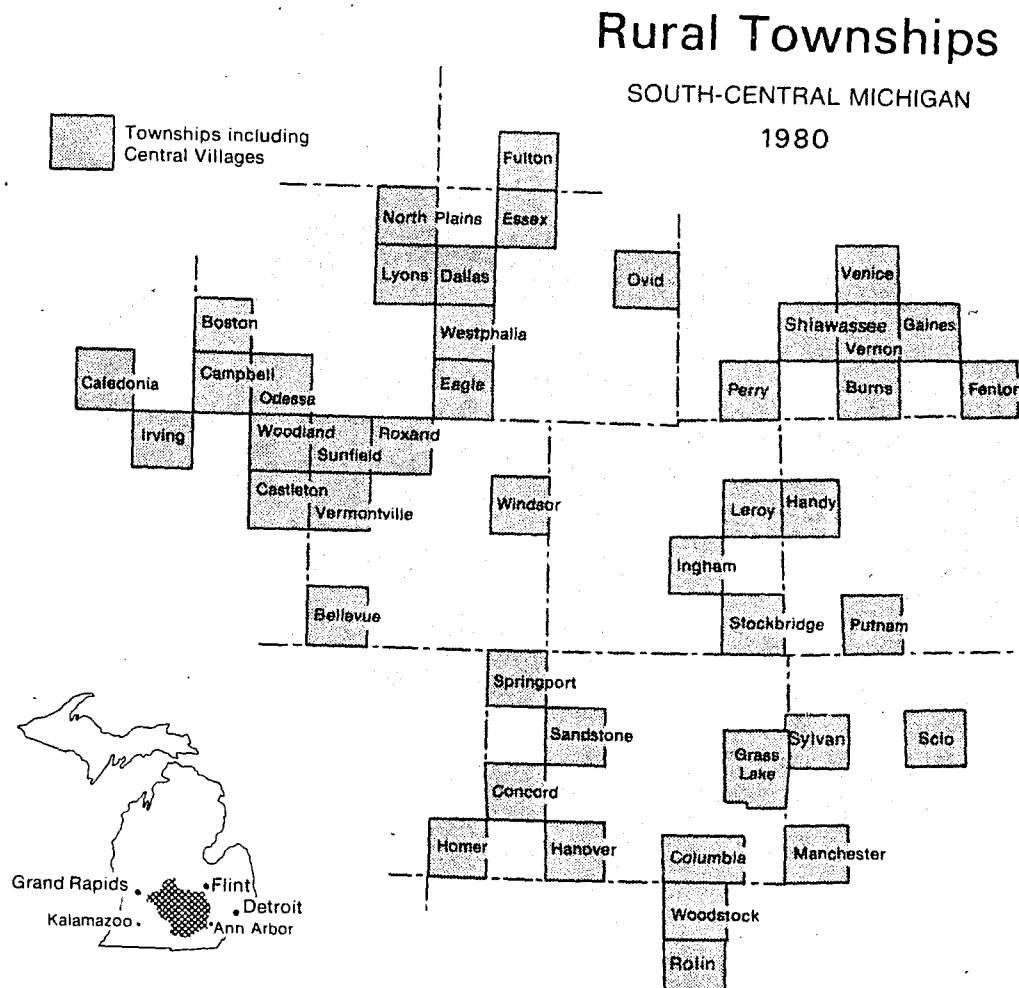


Fig. 2.4 Townships that surround the central villages of the study area.

TABLE 2.1: Population of Central Villages in 1980 and Their Z-Values

Central Village	Population	Z-value
1. Brooklyn	1,110	.134
2. Dexter	1,525	.748
3. Chelsea	3,816	4.140
4. Fowlerville	2,289	1.880
5. Saranac	1,421	.590
6. Manchester	1,686	.990
7. Linden	2,174	1.710
8. Pinckney	1,390	.550
9. Homer	1,791	1.140
10. Addison	655	-.540
11. Stockbridge	1,213	.287
12. Grass Lake	962	.085
13. Ovid	1,712	1.025
14. Lake Odessa	2,171	1.700
15. Bellevue	1,289	.399
16. Hanover	490	-.783
17. Nashville	1,628	.900
18. Fowler	1,021	.002
19. Dimondale	1,008	-.017
20. Sunfield	591	-.634
21. Caledonia	722	-.440
22. Webberville	1,535	.763
23. Cement City	539	-.711
24. Lennon	600	-.620
25. Concord	900	-.177
26. Parma	873	-.217
27. Westphalia	896	-.182
28. Morrice	733	-.424
29. Vermontville	832	-.277
30. Byron	689	-.489
31. Muir	698	-.475
32. Perrinton	448	-.845
33. Freeport	479	-.800
34. Bancroft	618	-.594
35. Vernon	1,008	-.017
36. Lyons	708	-.460
37. Maple Rapids	683	-.500
38. Pewamo	488	-.790
39. Springport	675	-.510
40. Mulliken	550	-.694
41. Woodland	431	-.870
42. Eagle	155	-1.280

(Con't)

TABLE 2.1: Cont

Central Villages	Population	Z-Value
43. Clarksville	348	-.994
44. Hubbardston	421	-.885
45. Gaines	440	-.857
46. Dansville	479	-.800
$\bar{X}$	1019.348	0.0
SD	675.56	1

SOURCE: Population sizes for the villages were collected from U.S. Department of Commerce, 1980 Census of Population: Number of Inhabitants vol. 1, Part 24 (Michigan), January 1982. Z-values calculated by author.

the mean and 26 percent in the zone above the mean. This distribution of villages population sizes, implied an agglomeration of village population Z values on the left side of the curve with a positive skeweness of 1.931. Therefore, most of the central villages were smaller rather than larger in their deviation from the population mean. These 46 villages were chosen as rural central places, because they are easily and practically identified by the U.S. Census Bureau of Population.

The study of the hierarchical central villages involved a rural settlement approach using some of the concepts of settlement geography and dealt with the rural part (subsystem) of the whole system of rural-urban settlements in the study area.

The central villages as rural nodes are distributed over the homogeneous region of southcentral Michigan. The physical and agricultural uniformity in the formal region (hinterlands of central villages) of the study area is adjustable within the assumptions of Christaller's classical

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All the villages included in this research had populations less than 2,500 persons; only Chelsea with 3,816 persons was an exception. This village was selected because it is called a "village" and is recorded as a township subdivision in the U.S. 1980 Census Of Population: Number of Inhabitants (MI 1982). The village of Barton Hills was omitted because it was not recorded in Dun and Bradstreet's Reference Book (1950) and also because it was incorporated in 1970 (1980 Census of Population: Number Of Inhabitants, 1982:24-21).

central place theory. The highway and super highway development in the study area, however, which does not allow the same relative location for all of the central villages studied (Figure 2.5), does not coincide with classical central place theory's rigid assumptions of uniform distribution of central places on the network of transportation and marketing. It is the adjustment possible within the later modified central place studies which relaxes this rigid assumption.

In defining a time dimension for this study, the researcher was concerned with the period of the recent past up to the present day, the aim being to determine the processes of change in the viability and spatial distributions of central villages since 1950, with a break in 1970, up to the present. It was felt this would be most helpful for speculation on future changes in the subject area. It was determined a thirty-year investigation would be adequate for this study. It is particularly important that this coincided with the beginning of a significant post-World War II trend of farm mechanization and modernization that has continued up to the present time. For congruency of data (U.S. Census of Agriculture information with U.S. Census Population data), 1950 was chosen as the beginning year for the thirty-year study. Another significant point was 1970, because the income of farmers was raised considerably in the period of 1950-1970 (due to increased farm efficiency and

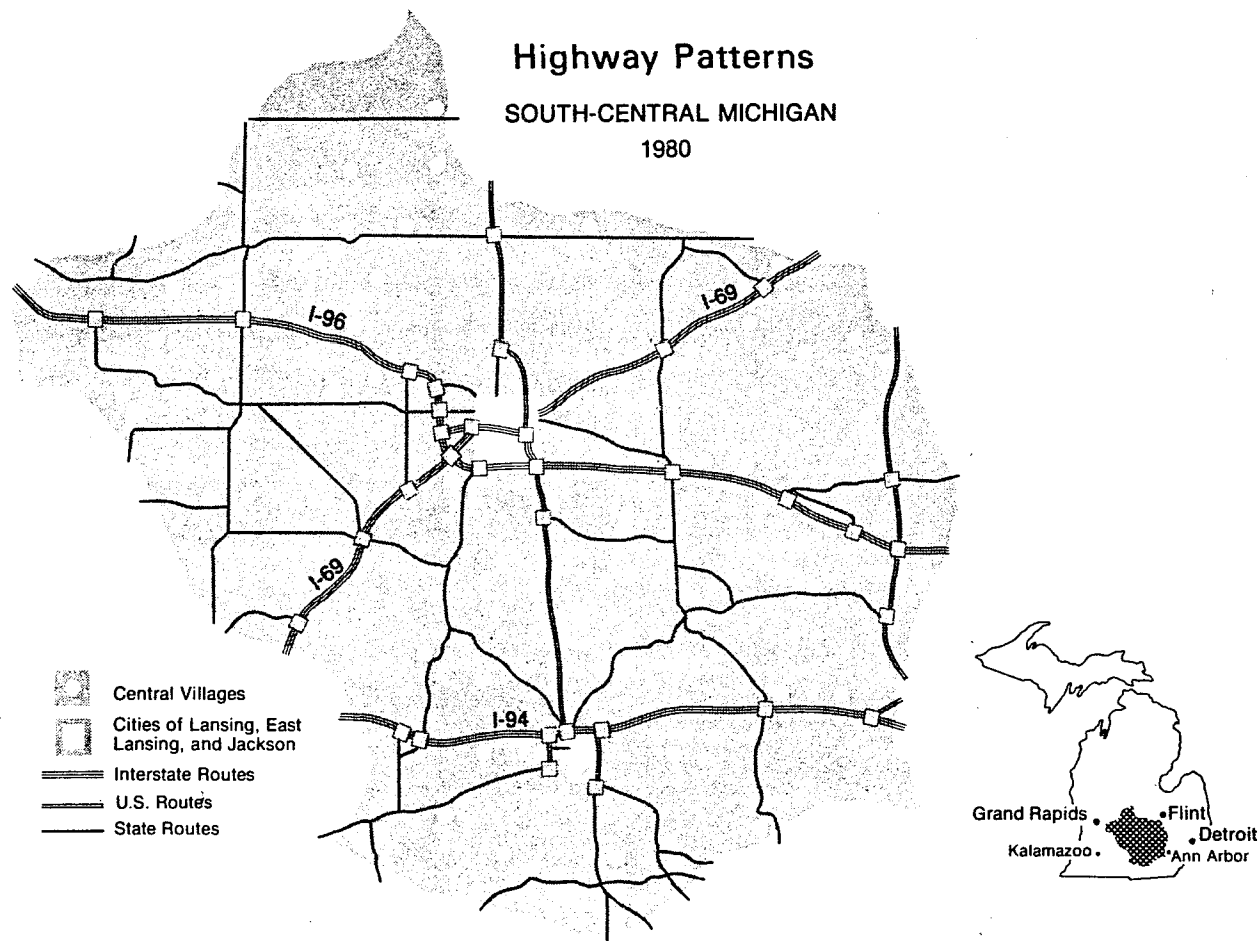


Fig. 2.5 The relative location of central villages of South-central Michigan on the highway patterns of the study area, 1980.

farm inputs). Finally, 1980 was the last year for which data were available, so that information is reasonably current. The data were analyzed at these three points and the intervals in between. Because available data about farming improvements and farm income is identified by counties in the U.S. Census of Agriculture, and does not include individual farm figures, the farmers' questionnaire in Appendix B was the main source for some required data. Questions related to farm industrialization and management (adopting farm automation, specialization and consolidation) were key questions to identify individual farmer's past performances in farm and rural development.

Data Sources

General Data

To collect the general data needed about rural development (agricultural and transportation) in the study area, the Michigan State University Library and the Michigan Department of Transportation in Lansing were consulted. General materials relating to modified central place theory, behavioral geography, and previous empirical studies were gathered at Michigan State University. Information about regional super highway development and transportation facilities, regional speed limitations and mileages of local roads and highways of central villages, were obtained from

the Library of the Michigan Department of Transportation in Lansing and through the questionnaires (Appendix B). The U.S. Department of Commerce, Census Of Agriculture (issued in 1952, 1972 and 1981) was used only for general information about trends of agricultural census in the 16 counties studied (Figure 2.2) for the years of 1950, 1969, and 1978, because detailed information concerning agricultural development was gathered by the researcher through field surveys. To obtain data on the numbers and types of functions and establishments in the villages, the Dun and Bradstreet, Reference Books for 1950, 1970 and 1980 were employed. In these directories all agglomerated settlements (urban and rural) of the U.S. are categorized by alphabetical order, and most of the functions for each settlement are depicted. Therefore, the Dun and Bradstreet directories were very useful for comparing data about the functions of each central village at the three points in time. A useful supplementary source was the local Telephone Directories for 1970 and 1980 that included data about current functions and services of settlements, arranged in alphabetical order by function and service. These were particularly useful for determining rural services such as attorneys, schools and churches that were not mentioned in the Dun and Bradstreet, Reference Books.

To gather the data concerning agricultural and rural development in the rural communities of the study area, two

types of questionnaires were developed. One was a public questionnaire (Appendix B) that was filled out in interviews with two knowledgeable persons in each sampled village (such as the clerk of the village or township, a teacher, librarian or other educated person active in the civic life of the area). The interview format of the public questionnaire was designed to extract information about specific local populations and the social and economic aspects of particular villages during the study period. Responses to questions involving the changing functions of grain elevators and railroads in transporting grains and cash crops to central villages were cross-checked with managers of elevators.

Another questionnaire was prepared to record interviews with individual farmers of the study area (Appendix B). This interview format was devised to determine individual characteristics, perceptions, and preferences of farmers, their rationale in farm development and their functional behavior in regard to the rural services of central villages in the past and present. A nonfarm questionnaire (Appendix B) was also prepared and administered to nonfarm families in the study area to determine the individual preferences of nonfarm people toward the central villages sampled. The rationale for including nonfarm people as well as the farmers was because of the increase in the nonfarm

population in the rural townships of the study area over the study period.

Sample Villages For Field Survey

It should be noted that, as a sample, 18 of 46 central villages (39.13 percent) in the study area were selected for the field survey.¹¹ The eighteen sample villages were drawn from the six hierarchical orders of central villages. Table 2.2 shows the order of all the villages in the study area in regard to their functional indices in 1980 (functional index classification is discussed in Chapter Four). The purpose of taking a sample of villages from the ordered list was to apply stratified random sampling (Taylor, 1977:75). By this method, it was possible to take an equal sample from each stratum. Villages within each stratum were similar and homogeneous, but different from villages of other strata. Three villages from each strata were selected randomly for field surveying. Choosing three villages for each strata was the best possible choice, because the first group of villages contained only three villages; therefore, this

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For the rest of the analysis (such as tables of functional index, correlation and regression models, and patterns of points for nearest neighbor analysis), all 46 villages were used because small samples can cause problems in these measures.

TABLE 2.2: Central Villages Ordered by Their Functional Indices, 1980

Villages	Functional Indices
<u>First Order Villages</u>	
1. Brooklyn	1,024.45
2. Dexter	1,012.23
3. Chelsea	986.53
<u>Second Order Villages</u>	
4. Fowlerville	615.25
5. Saranac	563.19
6. Manchester	519.41
7. Linden	515.13
8. Pinckney	484.33
9. Homer	465.47
10. Addison	458.00
<u>Third Order Villages</u>	
11. Stockbridge	377.21
12. Grass Lake	374.92
13. Ovid	369.57
14. Lake Odessa	360.68
<u>Fourth Order Villages</u>	
15. Bellevue	305.61
16. Hanover	290.84
17. Nashville	257.45
18. Fowler	249.11
19. Dimondale	225.94
20. Sunfield	211.86
<u>Fifth Order Villages</u>	
21. Caledonia	188.13
22. Webberville	187.51
23. Cement City	173.43
24. Lennon	152.17
25. Concord	151.05
26. Parma	144.43
27. Westphalia	144.12
28. Morrice	114.48

TABLE 2.2: Cont

Villages	Functional Indices
<u>Sixth Order Villages</u>	
29. Vermontville	93.33
30. Byron	86.41
31. Muir	81.66
32. Perrinton	69.30
33. Freeport	51.46
34. Bancroft	51.21
35. Vernon	41.12
36. Lyons	40.66
37. Maple Rapids	36.02
38. Pewamo	35.57
39. Springport	35.34
40. Muliken	34.66
41. Woodland	27.48
42. Eagle	17.07
43. Clarksville	16.46
44. Hubbardston	16.43
45. Gaines	15.41
46. Dansville	14.41

SOURCE: Author's calculations based on Appendix A: Table A.3.

method permitted an equal sample size per class of central villages. The selected villages were:

<u>First Order</u>	<u>Second Order</u>	<u>Third Order</u>
Brooklyn	Saranac	Stockbridge
Dexter	Pinckney	Ovid
Chelsea	Homer	Lake Odessa
<u>Fourth Order</u>	<u>Fifth Order</u>	<u>Sixth Order</u>
Hanover	Webberville	Byron
Nashville	Concord	Maple Rapids
Dimondale	Westphalia	Dansville

These eighteen sampled villages also served as the subjects for individual spatial behavior measures to examine how the farm and nonfarm families in townships surrounding these villages interact in their shopping preferences with these villages compared with other central places of the study area. In order to assure the validity of the farm and nonfarm questionnaires a preliminary survey was done in the townships surrounding the villages of Webberville and Fowlerville in June 1983. The experience showed that the personal interview yielded the highest rate of adequately filled-out questionnaires and also suggested that five completed farm family questionnaires (Appendix B) and five completed nonfarm family questionnaires (Appendix B) were the best possible goal for a one day survey in each selected village. This goal was also supportive of the time and budget considerations of the researcher. In order to select the samples of farm and nonfarm families, the Atlases and platbooks of Michigan for each central village and its related township (1980) were used. The technique of random

point sampling was chosen because the square patterns of townships and their sections, dotted with isolated farmsteads and rural dwellings, resemble patterns which Taylor recommends for the use of this method (1977:77). The selected farm and nonfarm families of the study area are shown in Figures 6.1.1 and 6.1.2.

Sampled Rural Functions (Goods And Services)

To determine the impact of farmers' individual and personal characteristics and their shopping habits on changes of viability and spatial distribution of central villages it was necessary to take a sample of goods and services, because there were more than 115 different functions (retail, wholesale, and services) in central villages of the study area at the time of the study. The selected functions (goods and services) were examined by using the farmers' and nonfarmers' questionnaires, with each sampled function oriented in regard to the subjects' responses to the related questions. In other empirical works, several different functions have been examined to explain the pattern of shopping choices of consumers. For instance, food, clothing, shoes, appliances, banks, auto repairs, doctors and dentists in Murdie's work (1965); groceries, kinds of foods, chemist drugs, flowers, hairdressing, hardware, shoe repairs and toys in the work of Davies (1969); women's wear shops in Burnett's work (1973); department stores in

Cadwallader's research (1975); grocery purchases in Williams' study (1979); shoe stores in the research of Brooker-Gross (1981); and retail food stores in Hall's research (1983).

In order to select the rural functions (goods and services) for this research, the researcher used a stratified random sampling of the location coefficients of central functions cited in Table A.3. These coefficients were ordered by computer and then classified in ten groups using natural breaks classification (Table 2.3). This technique was used, because it tended to put the same values of observations in the same group. Table 2.3 shows that eight groups have the same ranges while only the first and second group differ in their upper and lower limits. Ten classes of rural functions were considered reasonable given the time considerations and optimal benefit to this research. Then a function was drawn randomly from each strata. The ten functions drawn (Table 2.4) were inserted in the farmers' and nonfarmers' questionnaires. In order to identify the probability of association between farmers' and nonfarmers' individual characteristics and preferences toward their shopping centers (hierarchical order central villages and other central places) and these ten selected functions, a chi-square test was applied to each of the ten sampled functions. The "factors," "chi-square values," "degrees of freedom" (df) and the "amount of probability" are shown in

TABLE 2.3: Ranks and Classes of Rural Functions (Goods and Services) in the Order of Their Location Coefficients.

Functional Rank	Location Coefficient	Functions in the Order of Their Location Coefficients
<u>Class I</u>		
1	0.51	Church
2	1.45	School
3	1.54	Grocery Store
4	1.56	Doctor's Office
5	2.08	Hardware Store
6	2.13	Bank
7	2.63	Gasoline Service Station
8	2.77	Eating Place (Restaurant)
9	2.77	Dentist
10	3.12	Veterinarian
11	3.12	Attorney
12	3.22	Lumber and Other Building Materials Dealer
13	3.33	Motor Vehicle Dealership (New and Used)
14	3.33	Drinking Place (Bar)
15	3.70	Barber Shop
16	4.00	Farm and Garden Machinery and Equipment
17	4.54	Drug Store
18	4.76	Farm Supplies
19	5.00	Grain Elevator
<u>Class II</u>		
20	6.25	Nondurable Goods
21	6.66	Florist
22	6.66	Sporting Goods Store
23	7.14	Furniture Store
24	7.69	Miscellaneous General Merchandise Store
25	8.33	Women's Ready-to-Wear Store
26	9.09	Gift Shop
27	9.09	Liquor Store
28	9.09	Radio and Television Store
29	9.09	Auto and Home Supply Store
30	9.09	Variety Store
31	10.00	Automotive Parts and Supplies
32	11.11	Optometrist

TABLE 2.3: Cont

Functional Rank	Location Coefficient	Functions in the Order of Their Location Coefficients
<u>Class II</u>		
33	11.11	Repair Shop
34	11.11	General Automotive Repair Shop
35	11.11	Funeral Service
<u>Class III</u>		
36	12.50	Clinic
37	12.50	Petroleum (W.S.)
38	12.50	Durable Goods (W.S.)
<u>Class IV</u>		
39	14.28	Radio & Television Repair Shop
40	14.28	Fuel Oil Dealer
41	14.28	Jewelry Store
42	14.28	Boat Dealer
43	14.28	Retail Nurseries, Lawn and Garden Supply Store
<u>Class V</u>		
44	16.66	Sewing, Needlework and Piece Goods Store
45	16.66	Floor Covering Store
46	16.66	Men's & Boy's Clothing and Furnishing Store
47	16.66	Construction Materials
<u>Class VI</u>		
48	20.00	Cigar Store
49	20.00	Miscellaneous Home Furnishing Store
50	20.00	Family Clothing Store
51	20.00	Mobile Home Dealer
52	20.00	Petroleum Bulk Stations and Terminals (W.S.)
53	20.00	Industrial Supplies

TABLE 2.3: Cont

Functional Rank	Location Coefficient	Functions in the Order of Their Location Coefficients
<u>Class VII</u>		
54	25.00	Bowling Alleys
55	25.00	Reupholstery and Furniture Repair
56	25.00	Data Processing Service
57	25.00	Miscellaneous Retail Store
58	25.00	Liquified Petroleum Gas Dealer
59	25.00	Used Merchandise Store
60	25.00	Paint, Glass and Wallpaper Store
61	25.00	Lumber, Plywood and Millwork (W.S.)
<u>Class VIII</u>		
62	33.33	Engineering, Architectural and Surveying Service
63	33.33	Electrical and Electronic Repair Shops
64	33.33	Refrigeration and Air Conditioning Service & Repair
65	33.33	Motorcycle Dealer
66	33.33	Motor Vehicle Dealer (Used Only)
67	33.33	Meat and Fish Market
68	33.33	Department Store
69	33.33	Sporting & Recreational Goods and Supplies
<u>Class IX</u>		
70	50.00	Armature Rewinding Shop
71	50.00	Truck Rental and Leasing
72	50.00	Equipment Rental and Leasing Service
73	50.00	Advertising Agency
74	50.00	Hotel/Motel and Tourist Courts
75	50.00	Hobby Shop
76	50.00	Music Store
77	50.00	Household Appliance Store
78	50.00	Miscellaneous Apparel & Accessory Store
79	50.00	Automotive Dealer

TABLE 2.3: Cont

Functional Rank	Location Coefficient	Functions in the Order of Their Location Coefficients
<u>Class IX</u>		
80	50.00	Recreational and Utility Trailer Dealer
81	50.00	Candy, Nut and Confectionery Store
82	50.00	Meats and Meat Products
83	50.00	Groceries, General Line (WS)
84	50.00	Professional Equipment and Supplies (WS)
85	50.00	Poultry and Poultry Products
<u>Class X</u>		
86	100.00	Hospital
87	100.00	Welding Repair
88	100.00	Car Wash
89	100.00	Outdoor Advertising Service
90	100.00	Miscellaneous Personal Service
91	100.00	Carpet & Upholstery Cleaning
92	100.00	Dry Cleaning Plant
93	100.00	Power Laundry
94	100.00	Fuel & Ice Dealer
95	100.00	Mail Order House
96	100.00	Drapery, Curtain & Upholstery Store
97	100.00	Shoe Store
98	100.00	Children's & Infants' Wear
99	100.00	Miscellaneous Food Store
100	100.00	Retail Bakeries, Baking and Selling
101	100.00	Fruit Store and Vegetable Market
102	100.00	Freezer and Locker Meat Provisioners
103	100.00	Beer and Ale (WS)
104	100.00	Farm Product Raw Materials (WS)
105	100.00	Livestock (WS)
106	100.00	Groceries and Related Products (WS)
107	100.00	Dairy Products (WS)
108	100.00	Industrial and Personal Paper Service (WS)

TABLE 2.3: Cont.

Functional Rank	Location Coefficient	Functions in the Order of Their Location Coefficients
<u>Class X</u>		
109	100.00	Stationery Supplies (WS)
110	100.00	Transportation Equipment and Supplies (WS)
111	100.00	Service Establishment Equipment and Supplies (WS)
112	100.00	Industrial Machinery and Equipment (WS)
113	100.00	Plumbing and Heating (WS)
114	100.00	Metal Service Center (WS)
115	100.00	Furniture (WS)

SOURCE: Data was derived from Table A.3, classification of the functions in 10 groups was done by the natural breaks method (using computer)

TABLE 2.4: Ranges of Rural Functions' Location Coefficients and the Sample Functions Drawn From Each Range

Fre- quency	Range of Rural Func- tions' Location- Coefficients	Sample Functions	Sampled Functions† Location Coefficient
19	.51 - 5.00	Grocery Store	1.54
16	6.25 - 11.11	Optometrist	11.11
3	12.50 - 12.50	Clinic	12.50
5	14.28 - 14.28	Jewelry Store	14.28
4	16.66 - 16.66	Floor Covering Store	16.66
6	20.00 - 20.00	Family Clothing Store	20.00
8	25.00 - 25.00	Paint, Glass & Wallpaper Store	25.00
8	33.33 - 33.33	Department Store	33.33
16	50.00 - 50.00	Automotive Store	50.00
30	100.00 - 100.00	Shoe Store	100.00

SOURCE: Data was derived from Table 2.3 and samples were selected from each of the ten groups by stratified random sampling.

related tables 6.1.1 and 6.1.2 for each selected function. Finally, a chi-square "probability scale" (Taylor, 1977: 111-113) was constructed for each function examined (Figure 6.1.3). The chi-square "probability scale" practically and conveniently shows the clustered factors with similar probabilities which contribute to an association between farmers' and nonfarmers' individual characteristics and preferences (observable personality), and the selection of one of the ten sampled functions in a certain village or a certain central place of the study area. The results for each examined function can be generalized for other functions in the same class of location coefficients. This shows which factors have significantly influenced changes of viability and the spatial distributions of central villages.

Maps Diagrams, Tables and Graphs

To compare the spatial distribution patterns of central villages, in regard to their hierarchical order, in 1950, 1970, and 1980, maps and diagrams were prepared. Detailed discussions of this subject are found in Chapter IV: Socio-economic Modeling of Central Villages. Maps are provided to show the directions of individual spatial preferences in selection of one of the ten sample functions or services in a certain central village or a certain central place in the study area. This information was obtained from the survey of farm and nonfarm families.

Tables and diagrams provide the results of correlations (relations between population and function) and chi-square tests (relation between individual preference and selection of a function) using log-linear regression and chi-square probability scales. Graphs are used to show the changes in frequencies of a certain variable (such as population of the villages and agricultural data) over the time period of the study.

Data Collection And Analysis

To verify the hypotheses proposed for this research, the following analytical methods and techniques were used.

1. A functional index of classification with final grouping by an analysis of variance has been used to determine the accuracy of the hierarchical order into which the central villages are classified; an f-test has been applied. A hypothetical model of functional index classification is shown in Table 4.1.

2. To examine relationships between villages' population sizes or population served (townships' population) and numbers of functions (wholesale, retail and services) in the villages the correlation and regression analyses were used (Figures 4.4, 4.5, 4.6, 4.7 and 4.8).

3. To describe the changes in the agricultural technology and transport development in the region and their

impact in changing the viability and spatial distribution of central villages over the study time, Dun and Bradstreet, Reference Book, U.S. Census Of Agriculture, related regional development documents and the survey questionnaires (Appendix B) were used. Diagrams and figures have been prepared (Chapters Three and Five).

4. For determining the dot pattern of spatial distribution for the central villages in each different class over the study period, the technique of "nearest neighbor analysis" was used (Table 5.20). The standardization of village patterns by this technique was useful in explaining change toward regularity (dispersal) or irregularity (random).

5. "Chi-square probability scales" were used to determine the factors which influence the viability and spatial distributions of central villages. As it was hypothesized that there is an association between the choice behavior of an individual (farmer or nonfarmer) in shopping for a certain good at a certain central place and a particular factor (such as age, income, distance, etc.), the factors examined in the survey questionnaires were tested by chi-square analysis, tabulated and then arranged on chi-square probability scales (a hypothetical model was prepared to show the procedure (i.e., Tables 6.1.1 and 6.1.2 and Figure 6.1.3).

6. Shopping travel mileage for farm and nonfarm families for a certain function (department store, shoe store,

etc.) were measured and their mean values and standard deviations were calculated (Chapter Six). This technique was helpful to show the probable ranges of certain functions.

All of these techniques are discussed in greater detail at the points where their results are reported in this research.

Limitations

There were some problems in conducting this research. First, pre-1965 Dun and Bradstreet, Reference Books were not available in the Michigan State University or State of Michigan libraries. Because they are voluminous and consume so much space, they were available only in the Library of Congress and at Dun and Bradstreet's New York office. Likewise, copies of the Michigan Bell Telephone Directory for the study area were available only for 1980 at the Michigan State and State of Michigan Libraries; for the same reasons, the former years were not readily available. Therefore, to obtain the required data from the Dun and Bradstreet, Reference Book for the year 1950, the researcher visited the Library of Congress, in Washington, D.C. The telephone directories for 1970 (Michigan) were obtained at the Detroit Public Library.

As another problem, the 1950 telephone directories for Michigan were not applicable to this research, because the

rural services for several settlements were listed together. Delineation of which services belonged to which villages was thus impossible. Therefore, in the functional index classification of central villages in 1950 (Table A.1) only services mentioned in Dun and Bradstreet, Reference Book for 1950, have been used.

The sixteen counties which were either wholly or partially within the boundaries of the study region (Figure 2.2) each had individual listings of population and agricultural census data for the pertinent points of the study time. Therefore, to be objective in collecting the data, the related data for each individual county in the study area had to be taken and considered as a whole. In other words, there was no objective and justifiable way to delineate census data for the part of a county within the study area apart from data for that whole county.

Significance of the Study

The application of revised central place theory, with emphasis on the behavioral preferences of farmers and non-farmers who are the main consumers in central villages (trade centers), helps to resolve issues concerning the impact of rural development and farmers' shopping behavior on the viability and spatial distribution of central villages in southcentral Michigan, using comparative and explanatory analysis. The application of the theory at three points in

time (1950, 1970, 1980) in a cross-sectional approach helps to identify the rank/size relationship of central villages, the hierarchical structures of central villages, underlying interrelationships between the different orders of villages and significant agricultural and transportation developments that have taken place in the study area (1950, 1970, 1980). Indeed, the analysis of individual characteristics and preferences of farmers and nonfarmers in making shopping choices (biased behavioral choices) for certain functions) in the different orders of central villages discloses how much the viability of these villages is dependent on individual human behavior and preferences. In general, the results of the analyses of past and present situations will be helpful in suggesting recommendations for the future viability and spatial distribution of central villages. They may also be useful in regional planning for settlement development and establishing new functions, or eliminating other functions, in the central villages.

A significant aspect of this research is that this area (southcentral Michigan), for the thirty-year period of this research, has not been subjected to examination on the basis of the assumptions of revised central place theory with an emphasis on farmers' individual characteristics and preferences. Indeed, this study has concentrated on the rural portion of the study area's rural-urban system (Bracey, 1962;

and Johansen and Fuguitt, 1973; have studied the hierarchical order of such central villages in England and Wisconsin). In sum, this study was intended to determine the existence of hierarchical orders of central villages and their various competitive reactions to rural development and farmers' choice behavior. It was also intended to show changes in the hierarchical structure of central villages over the study period.

CHAPTER THREE
RURAL DEVELOPMENT IN SOUTHCENTRAL MICHIGAN

Establishment Of Early
Rural Settlements

Early rural settlements of white immigrants in south-central Michigan were begun after the 1830s. For example, Concord was established in 1831 (Hinkley, 1976:9), Homer in 1832 (Homer's Bicentennial Comm., 1976:4), Westphalia in 1836 (Westphalia Area History, 1976), Stockbridge in the early 1830s (Stockbridge Bicentennial Comm., 1976), and Webberville in 1871 (Webberville Area Centennial Book Comm., 1971:31). The early immigrants to the Midwest and southern Michigan came from Germany, the British Isles, and Scandinavia. They entered the U.S. and stopped briefly in New York City; then, using the Erie Canal, they migrated to Detroit (Hart, 1972:260, 263; Stockbridge Area Bicentennial Comm., 1976:16). The present farmers of southcentral Michigan migrated from New York or Detroit with their family origins in Germany, England, Scandinavia and other European countries.

Most of the early settlers were farmers who came to Michigan in search of farm land to grow crops, particularly wheat. The farmers' typical first rural homestead was a

handhewn log cabin for shelter, surrounded by land that was cleared from dense forests and prepared for cultivation. Oxen were used in the early immigrants' settlements because they were cheaper than horses in their use of coarse fodder; horses were used for hauling crops to market. Later, horses became typical work animals on farms. Agriculture was based on carrying crops (wheat, corn, potatoes), livestock farming and dairying (Hart, 1972:266; Homer's Bicentennial Committee, pp. 4,5; Westphalia Area History, 1976). This type of farming has remained dominant in southcentral Michigan up to the present time, but has been revolutionized by the agricultural industrialization in the region.

When railroad tracks were laid in the 1830s in southern Michigan it was a vital step in connecting the rural settlements to major markets. In some cases villages grew up around the site of a train station in a township, such as Fowler village in Dallas Township which was established in 1857 (Fowler Centennial Comm., 1957:4). In other cases the railroad was extended to connect existing villages to the larger centers and cities. For example, the villages of Dexter and Chelsea were connected by railroad extensions to Ann Arbor in 1840 and 1841 (Stockbridge Area Bicentennial Comm., 1976:16). The gravel primary roads established in the villages and their surrounding townships eventually became paved roads for motor transportation in the study area in later decades.

The typical features of early rural settlements in southcentral Michigan (1830s and 1840s) were graveled main streets that gave access to some small stores such as blacksmith shops, taverns, grocery stores, a village hotel, and garage for livery wagons, and some other rural services such as the post office, district school and the office of the village doctor. These features were responsive to the limited demands of farmers (new settlers) who lived in the countryside around the earliest settlements in southcentral Michigan.

Technological development in agriculture and transportation facilities has changed significantly the lifestyles of these farmers and their farming operations in the twentieth century. Technological changes in agriculture and transportation associated with today's rural life styles have changed these typical features of the early villages that offered simple local functions. Regarding the hypotheses of this research, agricultural mechanization and specialization; farm consolidation; and transportation development in the region since 1950, will be discussed here. It will be helpful to investigate the impact of these regional rural developments in changing the viability and spatial distribution of villages in the study area.

Agricultural Mechanization

According to the Census of Agriculture in the United States, USDA publications and bulletins and several issues of the Michigan Farmer, important farm mechanization took place in Michigan in the period 1950 to 1980. Along with agricultural mechanization, which included farm machinery such as tractors, motor trucks, and cornpickers, there were significant advances in the chemical and biological aspects of farming, such as fertilizers, herbicides and hybridization over the period of the study (Cochrane, 1977). The impact of this agricultural modernization has been increased farm output and productivity. Moyer, Harris and Harmon (1969:71) note that mechanization has been one of the main reasons for a rapid increase of farm output in the U.S. over the past few decades.

Draft animals (mules and horses) and tractors provided the work power on farms in southcentral Michigan in 1950. According to the U.S. Census of Agriculture, only one percent of farms had mules in 1950 (.02 average mules per farm), while 26.7 percent of farms used horses for work power (.61 average horses per farm). According to Table 3.1 the majority (55.83 percent) of farms in 1950 were operated with tractors only. The rest used draft animals, particularly horses in addition to tractors. The total number of draft horses declined, due to increased tractor use, in the study area over the study periods (Figure 3.1). While

TABLE 3.1: Number and Percentages of Work Animals and Tractors on Farms in 16 Counties of South-central Michigan, 1950

Source of work power	No Tractor, Horses or Mules Only	No Tractor & Only 1 Horse or Mule	No Tractor & 2 or More Horses	Tractor & horses and/or Mules	Tractor & No Horses or Mules
Total Number	8040	966	3592	8532	26706
Percent Value	16.81	2.02	7.51	17.83	55.83

NOTE: The total number of farms in 1950 was 47,836 in the 16 counties of southcentral Michigan included in the study area.

SOURCE: Derived by the author from county data provided in the 1950 U.S. Census Of Agriculture For The State of Michigan.

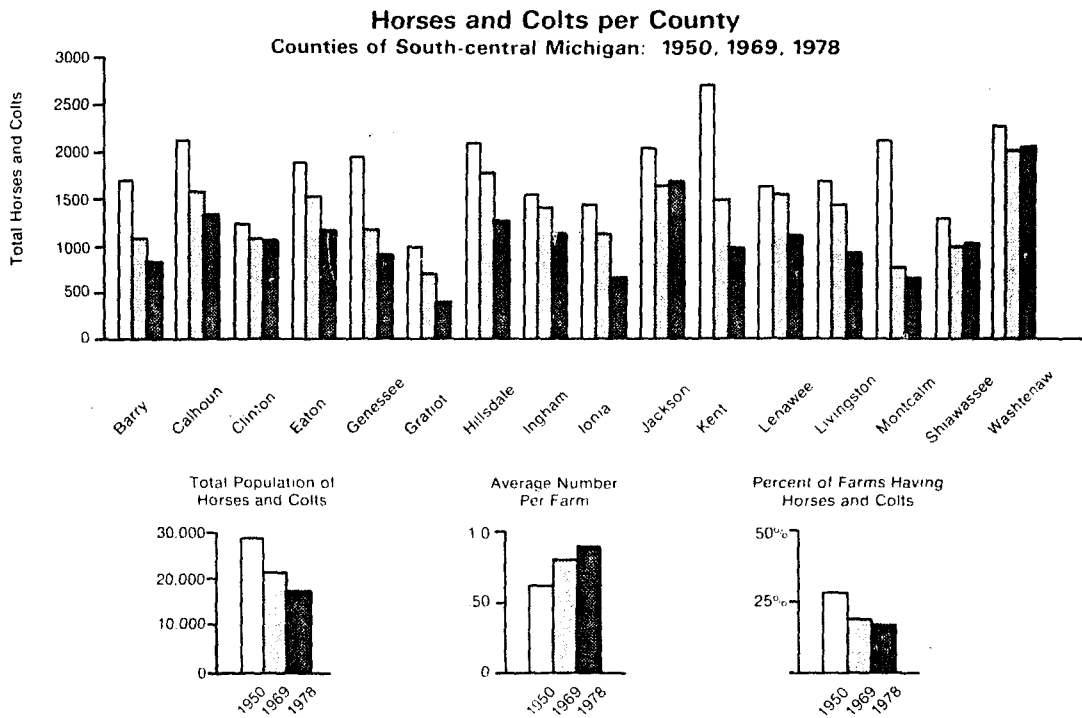


Figure 3 1 Population of horses and colts by counties and their distribution by average and percentage values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

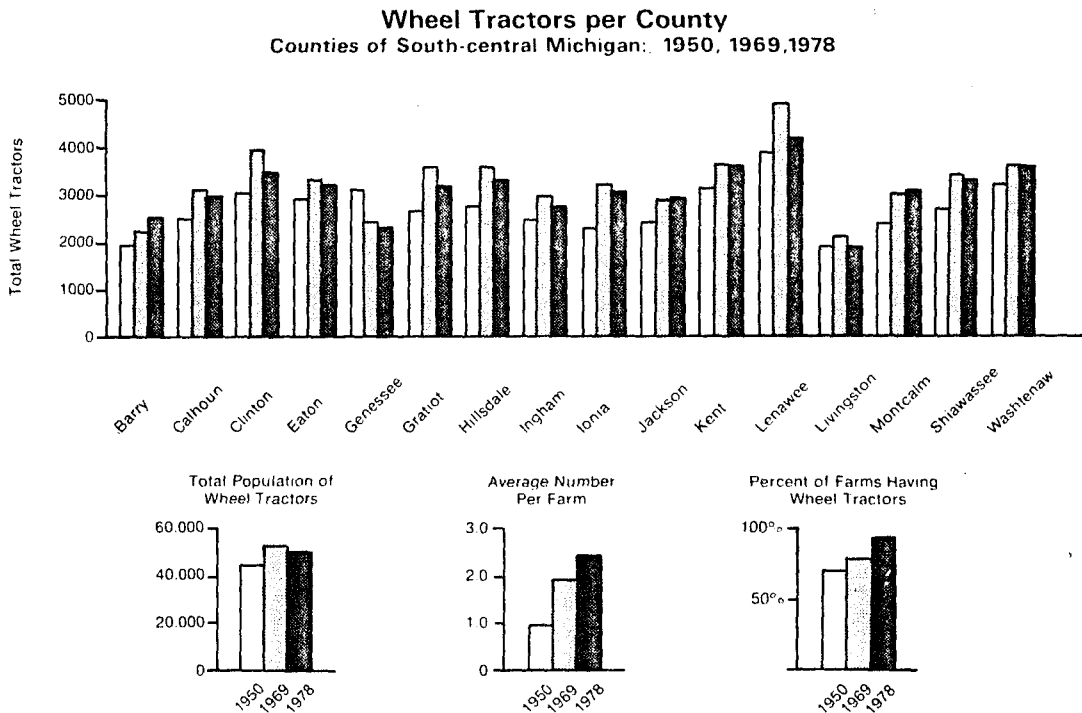


Figure 3 2 Population of Wheel Tractors by counties and their distribution by average and percentage values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

the percent of farms with horses was reduced, the average number of horses per farm increased. This increase was related to scientific horse breeding and the increased recreational use of horses in the study area since 1969.

The introduction of the tractor as the work power on farms in the United States in the very early twentieth century (Cochrane, 1979:108 and Wik, 1980:26) almost replaced the use of draft animals for farm power. A dramatic increase in the number of tractors on American farms in the 1920-1960 period (Cochrane, 1979:108, 122) continued in the 16 counties of the study area during the first period of the study (Figure 3.2). Seventy percent of farms had wheel tractors in 1950, 89 percent in 1969 and 93.6 percent in 1978 (Figure 3.2). The increased popularity of efficiency of wheel tractors was accompanied by advances in their power, speed, design and sophistication in the 1950-1980 period in the study area (for related literature, see Bloome, Grevis-James, Jones and Batchelder, 1980:115; Cochrane, 1979:122, 156, 197 and Michigan Farmer:1970, 1980). Along with the significant impact on farm mechanization of wheel tractors in the study area; cornpickers (corn combines) were the other type of farm machinery adopted in larger numbers by the farmers of the study area (Figure 3.3). Ownership of motor trucks, as vehicles for hauling some farm products also increased among the rural farm families (Figure 3.4).

Corn Pickers per County Counties of South-central Michigan: 1950, 1969, 1978

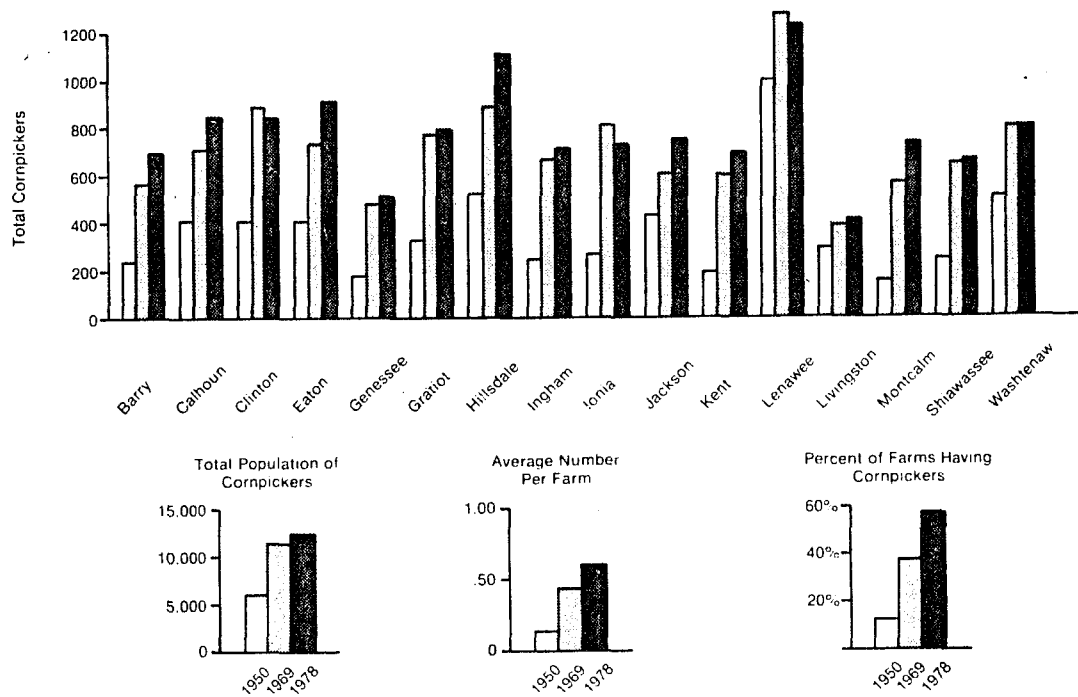


Figure 3.3 Population of Cornpickers by counties, and their distribution by average and percentage value in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

Motor Trucks per County Counties of South-central Michigan: 1950, 1969, 1978

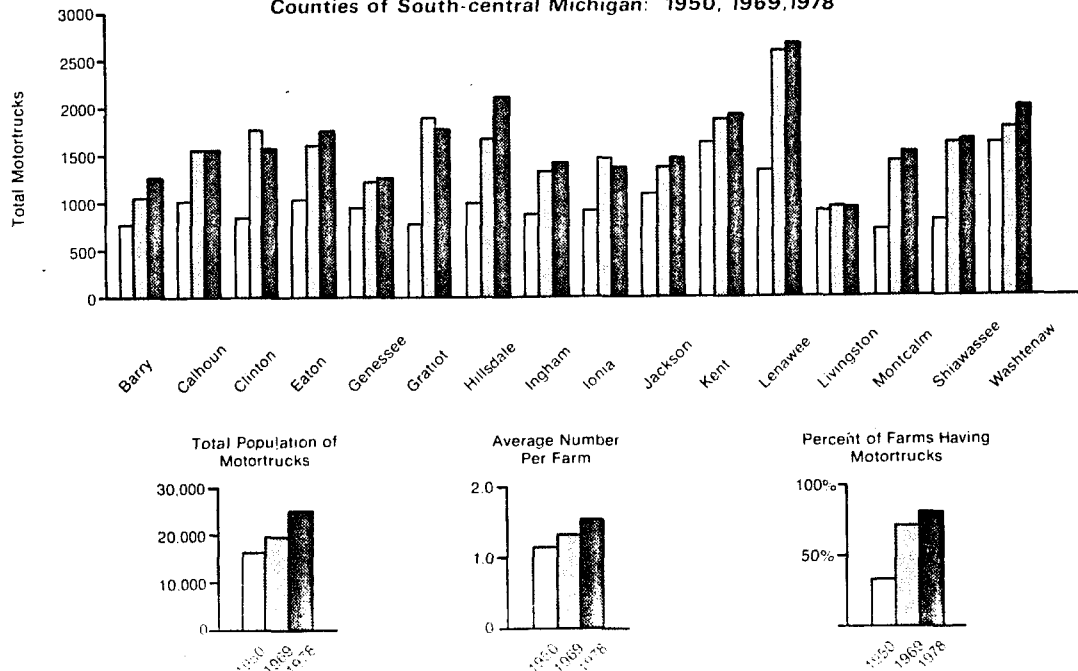


Figure 3.4 Population of Motortrucks by counties, and their distribution by average and percentage values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, 1978.

Biological and chemical developments in agricultural techniques included the introduction of better varieties of seeds, new fertilizers, and pesticides and herbicides which increased yields per acre in the study area over the study periods. Greater efficiency in livestock production and specialization of farms (Table 3.2) also changed the rural scene, which in the last thirty years has undergone a virtual revolution (particularly from 1950 to 1970) in farming methods with resulting and associated changes in rural life, both in the United States as a whole and in the region of this study.

In summary, the study region has benefited from agricultural mechanization in the direction of greater productivity and efficiency in farm operations. Local central villages that supplied functions for the horse-powered farming carried out with unsophisticated farm machinery in the 1950s, had to change their functions to those demanded by the mechanized and sophisticated farm operations prevalent in the area by 1978.

Specialization

On a map of Michigan, the study area for this research is characterized by dairy and general farming (Figure 2.1). Details drawn from the farm family questionnaire indicate that feed crops (oats and corn, hay, pasturage); cash crops

TABLE 3.2: Average Number of Livestock Per Farm and Percentages of Farms Raising Livestock in 16 Counties of Southcentral Michigan for 1950, 1960, 1978

	Average # of Cattle & Cows Per Farm	Percent of Farms Raising Cattle & Cows	Average Number of Milk Cows	Percent of Farms With Milk Cows	Average Number of Hogs and Pigs	Percent of farms Raising Hogs & Pigs
1950	11.92	75.27	5.50	69.90	6.78	41.71
1969	19.82	45.41	5.58	19.74	10.57	16.50
1978	21.93	41.84	6.89	15.23	15.32	15.02

SOURCE: Data collected from the U.S. Census Of Agriculture for 1950, 1969 and 1978

(wheat, beans and soybeans); livestock (beef cattle, steers and hogs); and dairying, along with various combinations of these agricultural activities, are predominant features of farming in the study area. The farm families who are involved in truck (vegetable) and fruit farming are in the minority, although most farmers raise fruits and vegetables for their own consumption. While fruit orchards are more common in western Michigan and bean farming on the east side of the state, it is apparent that most of the farmers in the southcentral region put their fields into feed crops to feed their livestock.

The trend to specialization is evident in these counties as it is throughout Michigan and the U.S. Durost and

Bailey (1970) point out that American farmers are becoming increasingly more specialized compared with their situation in the past. Farmers in the past had highly diversified farms, in that farms approached self-sufficiency through a high degree of complementarity between their livestock enterprises and their production of feeds for livestock. Specialization of agriculture, as a profitable business, is concentrated on the production of a certain crop such as wheat, or may cover all phases of producing, processing, and marketing a particular commodity, such as growing feed for dairy cows and producing fluid milk or other milk products for the consumer market (Kellogg and Everett, 1970:322).

Interviews with farm families in the study area identified specialized farm operations, including dairying, beef production, raising purebred sheep, horse raising, and grain and truck farming. Among these specialized types of farming, dairying is the most expensive and most profitable. The dairy farmers were found to have the highest incomes among farmers in the study area. Stewart and Davis (1980: 49) note that "Dairy production is an important agricultural enterprise in the United States, placing first to third in agricultural income in 16 of the 50 states."

It should be noted that improvements in agricultural mechanization and transportation have favored the specialization of agriculture in the study area. For example, milking machines on dairy farms in Michigan in 1950 were

simple and time-consuming. By 1970 they had become more sophisticated and more efficient. "Milking Parlors" by 1980 were fully automated with many time saving improvements and increased fluid milk production (Michigan Farmer, Jan. 1949: 6, 39-71; September 1950: 29-213; February 1971:20; March 1971: faced S-12; September 1980:56; and March 1981:43). The number of farms reporting they had milking machines in the 16 counties of the study area, declined from 15,940 (33 percent) in 1950 to 7,397 (23.8 percent) in 1964.¹² This was associated with the overall reduction in dairy farms and the increased number of milk cows per farm. In 1950, 68.9 percent of farms had milk cows, 19.74 percent in 1969 and 15.23 percent in 1978. The average number of milk cows per farm was 5.5 in 1950, 5.58 in 1969 and 6.89 in 1978 (U.S. Census of Agriculture). All these figures supported previous findings on the trend toward increased efficiency and specialization in the study area. Trucking the fluid milk, in better condition, in bigger and more sophisticated trucks, over highways and super highways to milk distributing companies such as the Michigan Milk Producers Association, has also helped to increase dairy productivity through agricultural specialization in southcentral Michigan.

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The 1964 Census of Agriculture recorded the last data available on farm facilities, including milking machines.

To conclude, it may be anticipated that the increased trend toward specialization was accompanied by farmers' demands for more sophisticated farming supplies that could not be made available economically in small local villages. However, specialized farming required the provision of more sophisticated and much more expensive equipment, supplies and services to fewer farmer-consumers.

Farm Consolidation

The decline in the number of farms in the United States since the 1930s and 1940s has continued up to the present day. The number of farms in the counties of southcentral Michigan decreased dramatically from 47,836 in 1950 to 27,395 in 1969 and continued to decline to 20,659 in 1978 (Figure 3.5). The decline in the number of farms has been a consequence of farm consolidation, that means larger and fewer farms (large scale agribusiness). The increasing size of farms has been accompanied by improvements in mechanization (Moyer, Harris and Harmon, 1969:16). Thus, technology has stimulated farm enlargement, consistently expanding the production capacities of farming (Sundquist, 1971:374). Large scale farms also benefit from advantages of discounts on bulk purchases, better marketing arrangements, credit availability, and tax write-offs (Sublett, 1975:4).

Increases in the average sizes of farms have affected all of the counties of southcentral Michigan. The mean farm

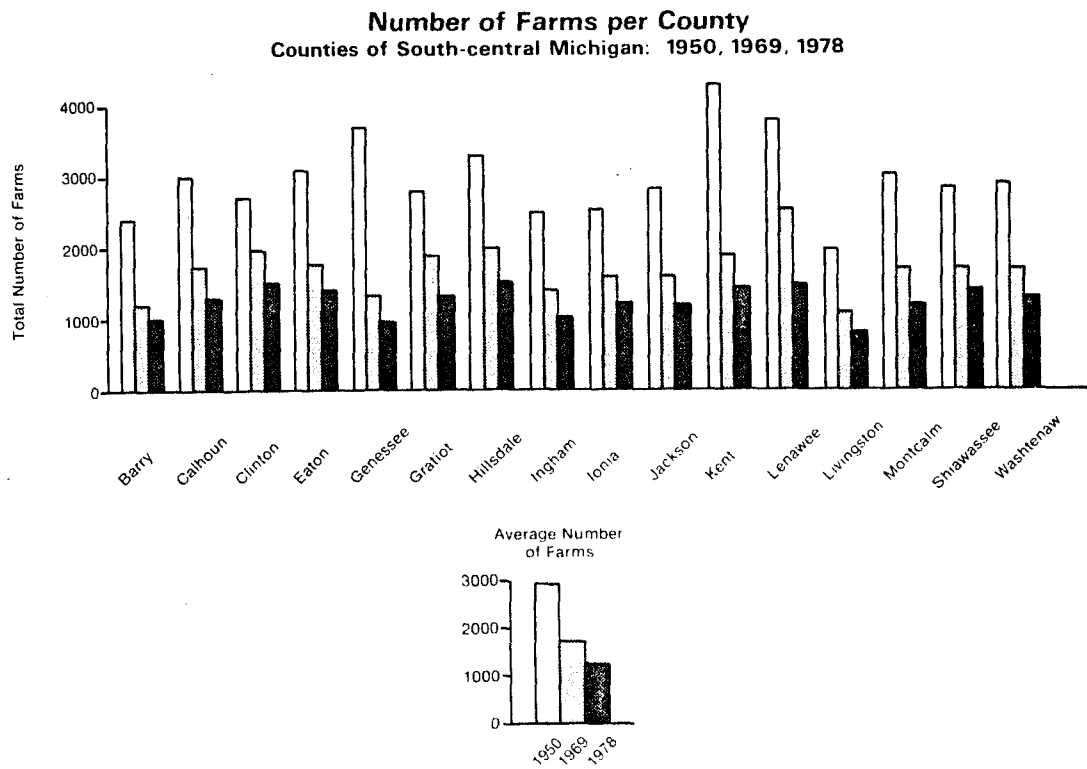


Figure 3.5 Total number of farms by county, and their average values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

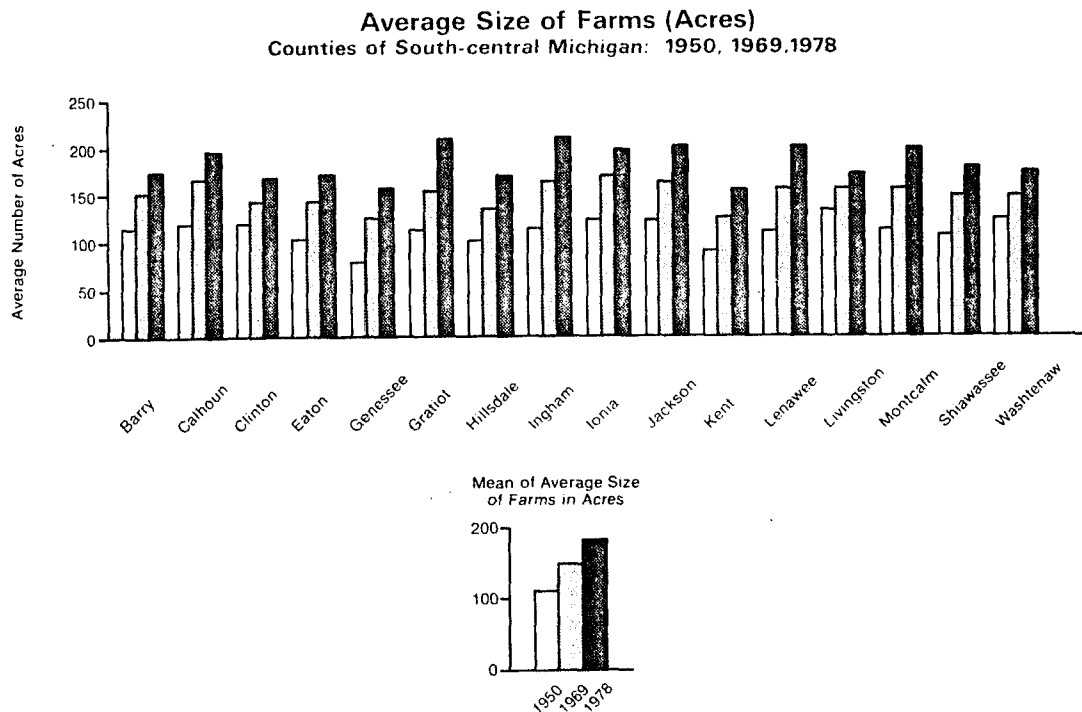


Figure 3.6 Average size of farms (acres) by counties; and their mean values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

size increased from 113.36 acres in 1950 to 152.15 acres in 1969 and 184.70 acres in 1978 (Figure 3.6). Thus, there was 32.2 percent change from 1950 to 1969 and 21.4 percent change during the period of 1969 to 1978. Changes in the average farm size in the study area are also credited with increasing farm incomes and productivity, reducing costs of farm operations and making farming more efficient (Moyer, Harris, and Harmon, 1969:16). For instance, price discounts on bulk purchases, including inputs of fertilizer and machinery available to large-scale farmers bring economies of scale to large-scale farming (Sundquist, 1971:374; Sublett, 1975:4). The economic problems of small scale farming are related to the high costs of machinery, over-taxation, and market prices too low to provide the small farmer with reasonable profit, according to data provided by Farm Family Questionnaires administered in 1983 (Appendix B). Farm consolidation in the study area resulted in a significant reduction of farm grossing less than \$10,000 over the periods of 1950-1969 and 1969-1978, while the numbers of farms grossing \$10,000-\$39,999 and \$40,000 and over have increased (U.S. Census of Agriculture for 1950, 1969, and 1978). Farm consolidation has meant that many farmers earning less than \$10,000 have gone out of business and their lands have been bought or rented by larger farmers who are mechanized or automated and can profit from economies of scale and specialization.

The process of farm consolidation has accelerated with the increase of part-ownerships of farming operations in the counties of southcentral Michigan. Hart (1972:258) notes that part-owner operations have facilitated recent increases in farm size in the Midwest. The percentage of farms under part-ownership in the counties of study area has increased from 18.6 percent in 1950 and 21.0 percent in 1969, to 32.5 percent in 1978 (Figure 3.7). Figure 3.7 shows that both average size and part-ownership trends follow an upward direction for the 1950-1969 period and in the 1969-1970 period, implying a relationship between these two variables. Conversely, part-time farming has slowed down this trend to increasingly larger farms in the United States (Moyer, Harris and Harmon, 1969:16). The importance of off-farm job income is vital to low income or the smallest farm operations (less than \$2,500 gross income) in the U.S. (Randall and Myers, 1970:25). In fact, most off-farm income in recent years has been earned by farm families who operate small farms, while the majority of net farm income is earned by the families who operate larger farms (USDA Handbook, 1980:5). This indicates that part-time farmers with their economically weak farm operations who depend on off-farm jobs are in danger of going out of the farming business. They operate in competition with full-time farmers who have larger-scale farm operations. Among the farm families interviewed in the study area (1983), there

Ownership and Average Size of Farms
Counties of South-central Michigan
1950, 1969, 1978

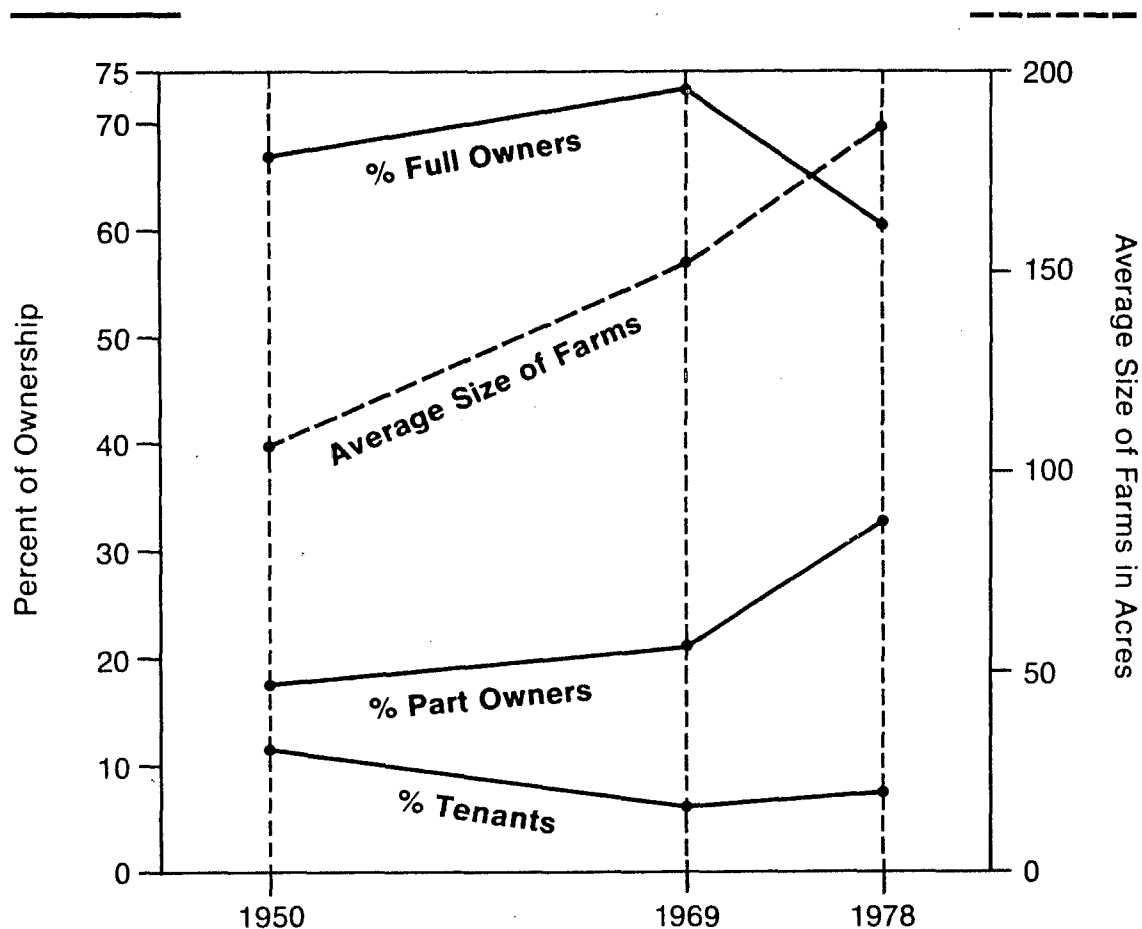


Fig. 3.7 Percent values of farm ownership types in comparison with the average size of farms in sixteen counties of South-central Michigan in 1950, 1969, and 1978. Data is collected from the U.S. Census of Agriculture (1950, 1969, 1978).

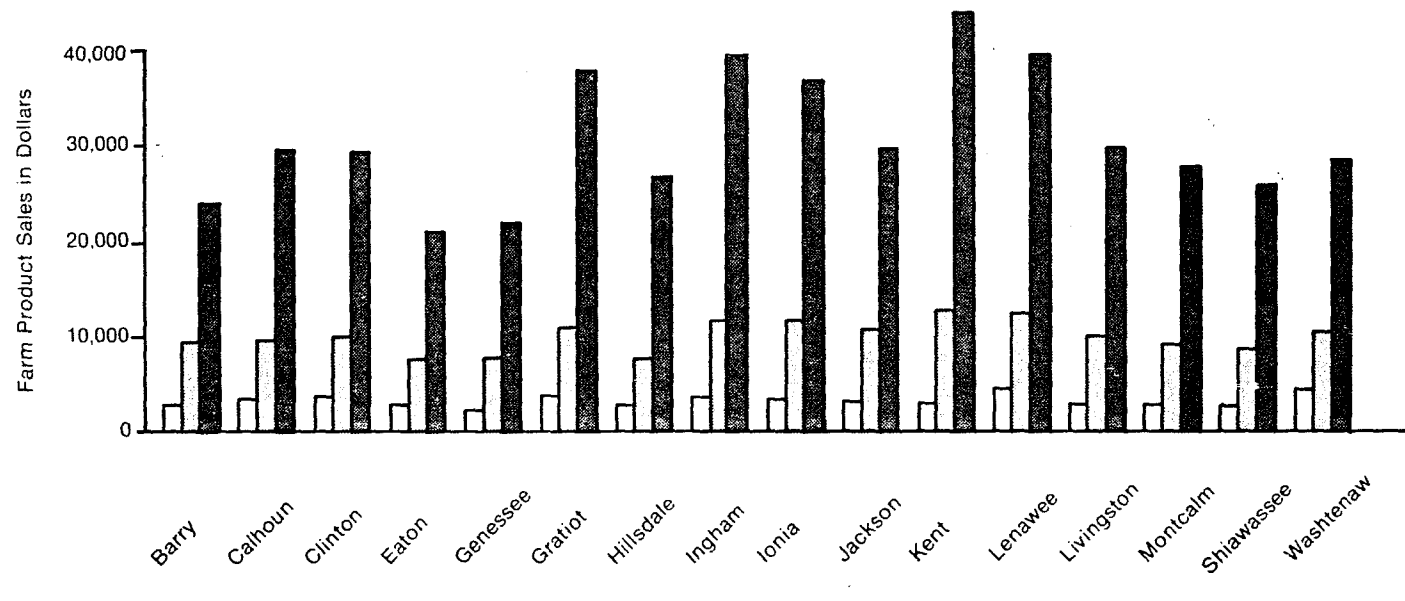
were 44.2 percent full-time farm operators, 45.3 percent part-time operators, 9.3 percent partially-retired operators and 1.2 percent veterans who had served in post wars. Given the continuation of farm mechanization and consolidation in the study area, part-time farming will be increased, with the extra acreage being consolidated into large-scaled and more specialized agricultural operations. This implies the failure of small scale farmers who cannot depend solely on their farm incomes any more, and eventually leave the farming business or rent their acres to larger farmers, to take full-time jobs in town or retire.

Gross Farm Income

The increase in farm mechanization, specialization and consolidation, in the counties of southcentral Michigan over the study time, has brought about significant increase in the production of farm outputs. This increase of agricultural productivity has meant a concurrent increase of gross farm income in the region.

In general, gross farm income in the 16 counties of southcentral Michigan has trended consistently upward over the study period. According to Figure 3.8, farm product sales per farm have significantly increased in each individual county. The average gross income almost tripled from 1950 to 1969, and tripled again in the period of 1969-1978. In light of the earlier discussion of prosperous

Sales of Farm Products per Farm (Dollars) Counties of South-central Michigan: 1950, 1969, 1978



Average Sales of Farm Products Per Farm in Dollars

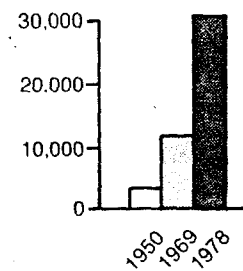


Figure 3.8 Farm product's sales per farm (Dollars) by counties; and their general average values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

developmental improvements in farm mechanization, specialization and consolidation in the study area, the upward trend of farm income in this area is considered a productive consequence of rural farm development since 1950. The 1970s were particularly good for American farmers, because of available markets to sell their farm products and easy credit for purchasing land and new farm machinery (State News, Jan. 19, 1983). The prosperity and farm development in the 1970s has been blamed for overproduction and a consequent reduction in feed grain and food prices in the early 1980s. It has been suggested that governmental policies toward stabilizing farm prices in domestic and international markets and a deliberate policy for retaining foreign markets for American farm products (particularly grain surpluses), accompanied by lower interest rates and easier credit could have helped more farmers survive the competition of big business-oriented farming in the 1980s (State News, Jan. 19, 1983; Cochrane, 1979:162-169). Among the farm families interviewed in this study, it was found that large-scale farming was productive and economically beneficial in the early 1980s, but small farm families faced financial problems.

As a consequence of rural agricultural development in southcentral Michigan, the functions offered in the local central villages were changed. When only 55.83 percent of farms were using tractors exclusively (Table 3.1), the rest

were using both tractors and draft animals as farm power (in the 1950s); and functions such as blacksmithing, shoeing, harness repair and welding were still available in the central villages. By 1970 and 1980 these functions had declined or disappeared. Farm machinery and supply stores in the area increased in number in the 1950-1970 period, associated with farm mechanization that required modern products for farm operations. Grain elevators and feed stores declined in their spatial distribution over the study time, due to a concentration of better and larger grain elevators and feed stores that were more specialized and responsive to farming development. Consequently, small local grain elevators were abandoned as fewer but more efficient grain elevators and feed stores became predominant in the study area and were able to take advantage of economies of scale. Of course, the development of more modern, swifter transportation has been germane in this spatial dispersion. Likewise, the evolution of transportation has been another significant component of rural development throughout the study area.

The Evolution Of Transportation and Highway Development In Southcentral Michigan

The pattern of the rural landscape in southcentral Michigan has seen important changes in transportation networks from the domination of the railroads in the 1950s to a super highway oriented transportation network in the 1970s

and 1980s. The railroad was a dominant feature in the U.S. transportation landscape in 1920, but motor vehicles, passenger cars, trucks and buses became dominant in the 1930s. Their development continued in the 1940s and 1950s (Ratner, Soltow and Sylla, 1979:439). The total main railway track in the United States was 254,000 miles in 1916, which declined to 205,000 miles in 1970 (Ibid:442). Michigan railroads, part of the Eastern district railroads of the U.S., lost traffic between 1940 and the 1970s (Richards and Thaller, 1978:252-254). The decline of railroad traffic in rural America, portends a continuous reduction by abandonment or discontinuance of thousands of miles of rails in the next few years (Kaye, 1980:268). The declining railroad function in the United States between 1929 and the 1970s was related to changes in industrial locations, shifts in population and markets, the development of trucking and the development of new raw material sources that have contributed to the prosperity of America's western railroads and railroad bankruptcies in the northeast and Midwest (Richards and Thaller, 1978:255). As a result, several railroad stations in the study area have been consolidated and old stations abandoned.

The decline in the viability of railroads in the Midwest has been accelerated by freeway development and trucking. According to the Atlas and platbooks of Michigan counties for the 1950s and the field surveys of this researcher,

80.5 percent of 46 central villages of this study were benefitted by the railroad in the early 1950s. The significance of railroads to central villages in the vital shipment of agricultural goods has faded to benefit trucking. Of the central villages surveyed, 83.5 percent had lost their railroad functions that were frequently a vital element in maintaining their local grain elevators. Some of these villages, including Brooklyn and Dexter, had lost their railroad functions by 1965; several other villages, such as Stockbridge, Homer, Nashville, Concord, Hanover and Saranac have lost railroad service in the past five years. The railroad has lost gradually its former importance in the central villages due to the prevalence and economies of super highway-oriented transport, particularly trucking.

The number of trucks registered in the U.S. grew from 4.8 million in 1940 to 17.6 million in 1970 (Ratner, Soltow and Sylla, 1979:448). This shows that the popularity of trucking for freight hauling in the U.S. has arisen to supplant the railroad function. This situation was evident in field surveys of the central villages since the railroads, for reasons of economy of scale, were no longer stopping in the villages and even their tracks had been removed from some of the central villages. Local elevators depend on trucks for shipment of grain or crops. In some cases, farmers of the study area own their own trucks for marketing

their farm products. In addition to being less expensive, in many respects, trucks are preferred over the railroad, for their ability to deliver product to market more quickly and their flexibility in distributing a particular product to a particular destination.

The increased popularity of truck ownership by farmers in the counties of southcentral Michigan is shown in Figure 3.4. The percentage of farms having trucks was 34.2 percent in 1950 which increased to 72 percent in 1969 and increased again to 84 percent in 1978. The quality and design of these trucks has also changed since 1950 in response to the demands of more mechanized and efficient farmers in fast-paced farm operations. The modern farm trucks can handle larger loads for fewer trips, saving time and labor expense and creating more profits for the farmers (Michigan Farmer, 1950, 1970, 1980). The increased truck ownership by the farmers in the study area has increased the usage of trucks on the highways and expressways where they often substitute for family cars. Figure 3.9 reveals an almost stable number of automobiles per farm, while there is a noticeable decrease in the number of farms having automobiles in the study area, over the study period. The decline in the total number of automobiles in Figure 3.9 is again related to the decrease in the number of farms and farm families due to farmers leaving the farming business. In contrast, the non-farm families interviewed were very likely to have more than

Automobiles per County Counties of South-central Michigan: 1950, 1969, 1978

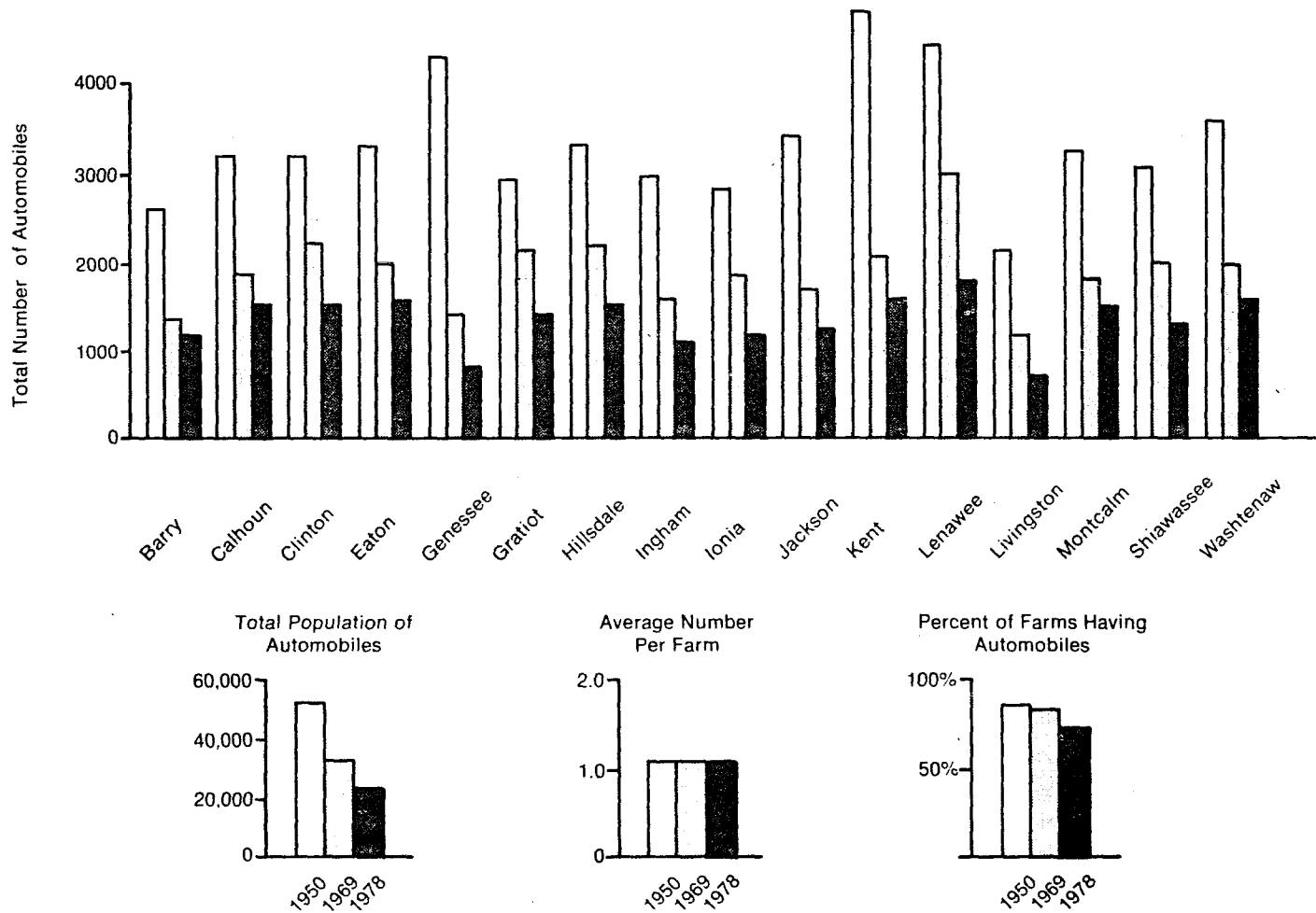


Figure 3.9 Population of Automobiles by counties; and their distribution by average and percentage values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

one private car. It may be concluded that highway development in the study area has been due, in part, to the trend of truck-oriented shipment of agricultural products and also to the increase of private cars due to an increasing nonfarm population in the rural townships. Of course, metropolitan growth has also been an influential factor in the development of regional transportation.

Population shifts and population growth have also been important factors in the regional development of the United States and its systems of roads and highways. Population growth, its characteristics and its distribution should be considered in the analysis of any trunk line planning because forecasts of the future growth and patterns of population and their mode of transportation are vital in developing highway networks (Michigan Department of State Highways, 1970:17). Considerable population increase took place in Michigan and its southcentral counties in 1950-1970 and 1970-1980 periods (Table 3.3). In-migration has been the reason most responsible for population growth in the region, in both its urban and rural areas. Regarding the higher rate of change in population growth in the period of 1950-1970 than 1970-1980, it was anticipated that dramatic changes in highway development and transport facilities in southcentral Michigan occurred in the earlier period. It should be noted that farm depopulation in the study area was compensated by the in-migration of rural nonfarm residents.

TABLE 3.3: Patterns of Population in the Counties of South-central Michigan in 1950, 1970 and 1980, Showing Percent Change for 1950-1970 and 1970-1980

	Total Popula- tion	Percent Change	Urban Popula- tion	Percent Change	Rural Popula- tion	Percent Change
1950	1,464,778		910,104		554,674	
1950- 1970		47.2		55.1		34.3
1970	2,156,890		1,411,816		745,074	
1970- 1980		9.5		7.0		14.2
1980	2,361,552		1,510,880		850,672	

SOURCE: Data is compiled by the author from the U.S. Department of Commerce, Census Of Population: 1950, Vol. II Part 22: Michigan, 1952: U.S. Department of Commerce, 1970 Census Of Population, Vol. 1, Part 24: Michigan, March 1973; and U.S. Department of Commerce, 1980 Census Of Population, vol. 1, Part 24: Michigan, January 1982.

In a reciprocal relationship, increased population encouraged transportation system development and improved accessibility was attractive to newcomers.

Since modern flexibility of movement due to motor vehicle travel has enhanced transportation by private carrier, freeway (interstate highway) development has created distinguishable interconnections between metropolitan centers (Mackie, 1963:8). The construction of the national system of Interstate and Defense Highways in the United States was approved by Congress in 1956 (Utah State Dept. of Highways, 1961). The first such interstate highways located in Michigan were I-94, I-96 and I-75, with the later addition to a proposed I-69, which was partially improved in the early 1960s (Mackie, 1963:9,10). Figure 3.10 shows the location of the abovementioned interstates in southern Michigan. I-94 connects the metropolitan center of Detroit to the metropolitan center of Chicago in Illinois; I-96 connects Detroit to Muskegon and Benton Harbor in western Michigan; and I-75 connects Detroit with Michigan's Upper Peninsula and Canada to the North, and to Cincinnati (and eventually Florida) to the South. The approved part of I-69 connects Marshall, Michigan (passed by I-94) to Indianapolis (Indiana), while the proposed part of I-69 was a connector from Marshall to Port Huron that passed through Lansing. Most of approved I-69 was opened to traffic in 1973 and it was completely constructed by 1976 (Michigan State Highway

Super Highway Networks, Michigan **1963, 1969, and 1978**

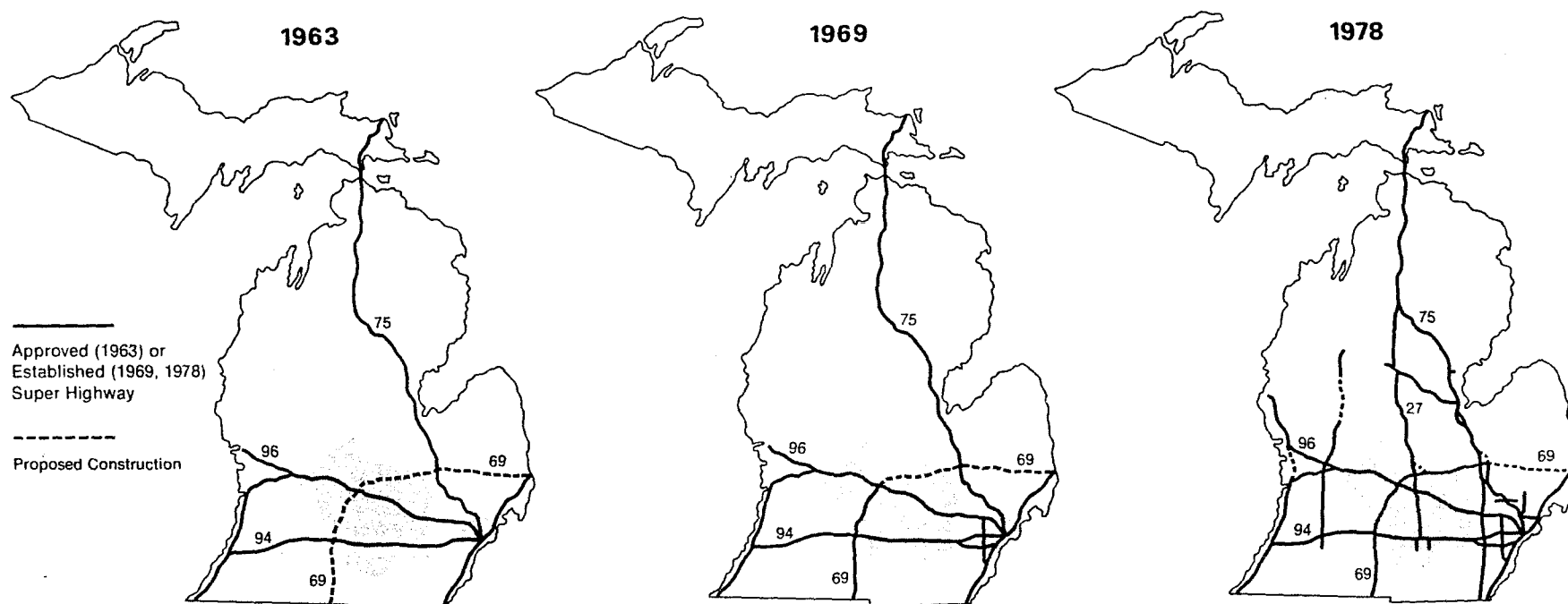


Fig. 3.10 The establishment and development of the interstate highway system in the state of Michigan and the study region. Sources: John C. Mackie (Commissioner), Michigan State Highway Department, *Proposed Extension of Interstate 69*, 1963; Michigan Department of State Highways, Transportation Planning Division, *Environmental Impact Statement for I-69, Charlotte to I-96 Northwest of Lansing: Clinton and Eaton Counties, Michigan*, 1969; and Michigan State Highway Commission, *1977 Annual Report*, Michigan Department of State Highways and Transportation, January 1978.

Commission, 1977:5). Interstate highway patterns in south-central Michigan have favored increasing Michigan farmers' access to the markets of adjoining states, including Illinois, Indiana, and Ohio. Farmers now take advantage of this access to choose the best market for their agricultural products.

Expressway construction, including interstate highways, in this country has led to the development of more capable and efficient modern transportation. Expressways, as principal trunkline highways, are designed with multi-lane divided roadways, to cover wide and long routes in a manner that facilitates high speed traffic, particularly commercial vehicles, while other, narrower trunklines are appropriate to lower speed vehicles and shorter-trip traffic (U.S. Dept. of Commerce, 1962:25). Therefore, construction of the interstate highways in Michigan has tended to increase the accessibility of the people of this state and the study area.

The increasing availability and use of expressways in recent years in the State of Michigan reflects the importance of increased regional accessibility and greater population mobility. Routes over modern efficient roads (expressways) that can handle heavy, high speed traffic have been substituted by truckers and travelers for routes over older and narrower highways built in the past. Freeway mileage in the State of Michigan (Michigan charges no high

way tolls) increased from 1,545 miles in 1973 to 1,674 miles in 1977 (Michigan State Highway Commission, 1973:6 and 1978:4). Interstate highways totaled about 895 miles in 1969, which increased to 1,024 miles in 1973 and 1,181 miles in 1977 (Michigan Dept. of State Highways, I-69-2 (7)62, 1969:1A; Michigan State Highway Commission, 1973:6 and 1978:4).

The absence of interstate highways in Michigan in the early 1960s compared to 1969 (895 miles) and 1977 (1181 miles) demonstrates that the emergence of interstate highways in the 1950-1970 period was dramatic and revolutionary compared to their evolutionary development in the later period of the 1970s. These findings suggest that essential changes in the socioeconomic viability of central villages also occurred during the first period of this study. The impact of transport development on the viability and spatial distribution of central villages is discussed in Chapter Five.

The Effects Of Rural Development In Changing The Pattern and Characteristics of the Rural Population

Agricultural industrialization and transportation in the study region from 1950 to 1970 was a revolutionary developmental process in changing the spatial patterns of population in the central villages and the countryside surrounding them. Agricultural mechanization reduced the number of workers needed on the farms and farm consolidation

reduced the number of farms and farm families. Meanwhile, the establishment of interstate highways in the 1960s increased mobility among urban and rural people in south-central Michigan so that rural farm depopulation and farm consolidation was accompanied by an influx of new (non-farm) population who were employed in the cities of southern and mid-Michigan, but resided in the countryside.

This influx of non-farm people exceeded farm depopulation to the extent that the counties of southcentral Michigan experienced an overall population increase (Figure 3.11) from 1950 to 1970 of 47.2 percent for the study region. The growth of population in the urban centers was 55.1 percent and 34.3 percent in rural areas (See Table 3.3). This significant population growth in southern Michigan in the 1950-1970 period was largely due to immigration promoted by the developments in transportation facilities. The greater rate of population increase in the urban areas may have been related to greater job opportunities, particularly in the manufacturing and government sectors in the period of 1950-1970 (when industrial policy was centrally oriented). Unemployed agricultural workers were drawn to the jobs available in metropolitan and urban areas. The increase of rural population (34.3 percent) in that period was related to the migration of non-farm people from nearby cities and towns. All of the central villages of the study area, and 96 percent of the rural townships

**Total, Rural, and Urban Population
Counties of South-central Michigan
1950, 1970, 1980**

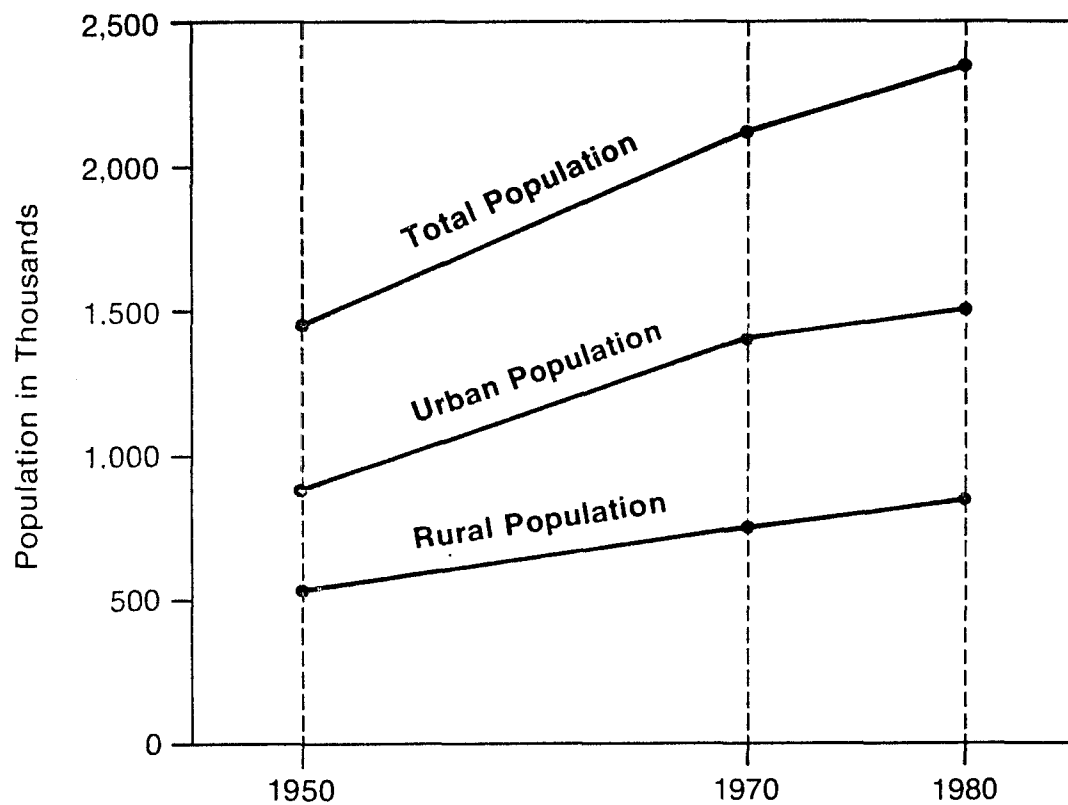


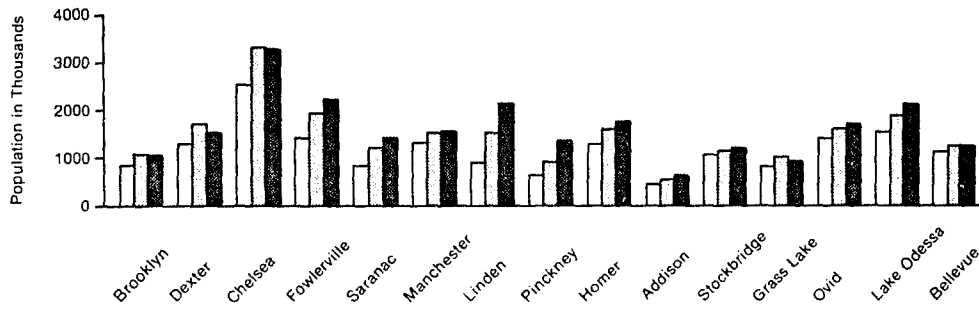
Fig. 3.11 Total population, urban population and rural population of sixteen counties of South-central Michigan in 1950, 1970, and 1980. Data is collected from the U.S. Census of Population (Census of Population: 1950; 1970 Census of Population; 1980 Census of Population).

surrounding them, gained population from 1950 to 1970 (Figure 3.12). The late 1960s saw the greatest movement of nonfarm people to the rural areas during this period.

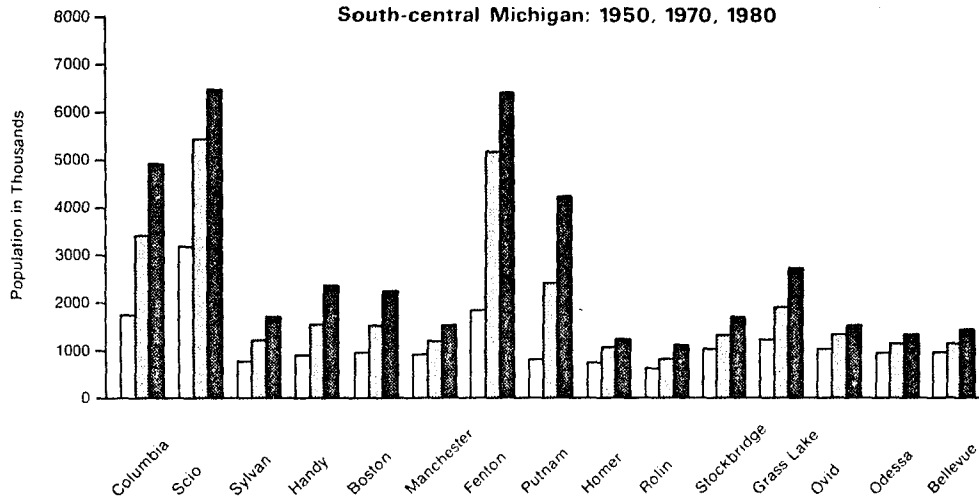
Farm consolidation, farm mortgage foreclosures and the increased willingness of farm families to sell all or parts of their farms caused the reduction in the farm acreage in southcentral Michigan between 1950 and 1970 (Figure 3.13). Over this period there was a 21.9 percent decrease in farmlands. Some farmlands were either consolidated or incorporated under new managers or farm owner-operators. Other farmlands were subdivided for housing tracts and rural apartments and condominiums, especially those near town and village limits. This process of subdivision and conversion of farmlands was continued in the later decade of the study period (1970-1980).

From 1970 to 1980, the population increase in the study region was 9.5 percent, much lower than in the two earlier decades (See Table 3.3). Both urban and rural areas of the study region gained population, 7.0 percent in urban areas and 14.2 percent in rural areas (Table 3.3). The increase of population in the area was related to the continuing transportation development that promoted more mobility and commuting between home and work. The higher rate of increase in the rural areas in comparison with urban centers may be related to increasing manufacturing employment in nonmetropolitan areas (decentralization) that was a trend in the

Rural Village Population
South-central Michigan: 1950, 1970, 1980



Rural Farm and Non-Farm Population
South-central Michigan: 1950, 1970, 1980



Rural Township Population
South-central Michigan: 1950, 1970, 1980

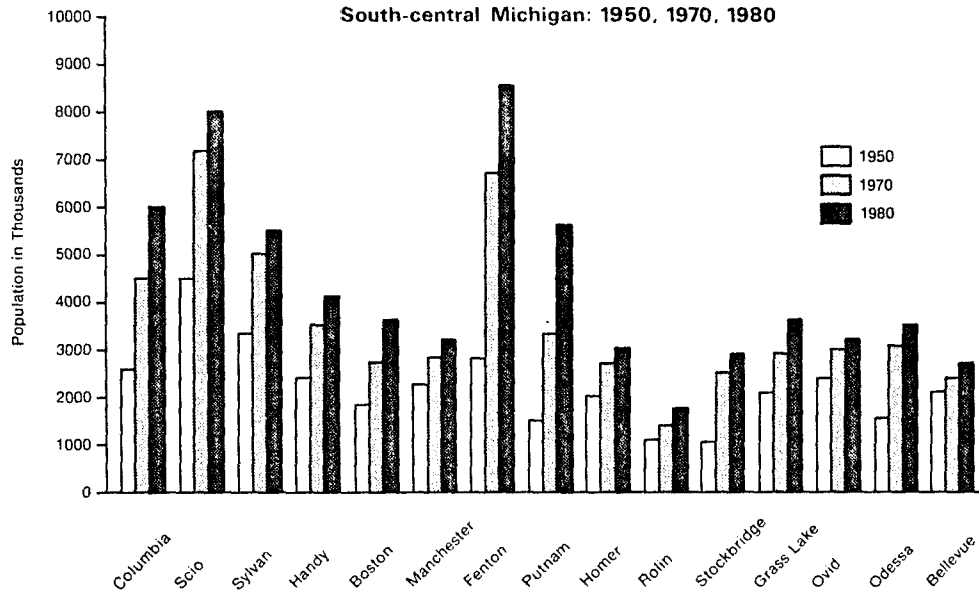
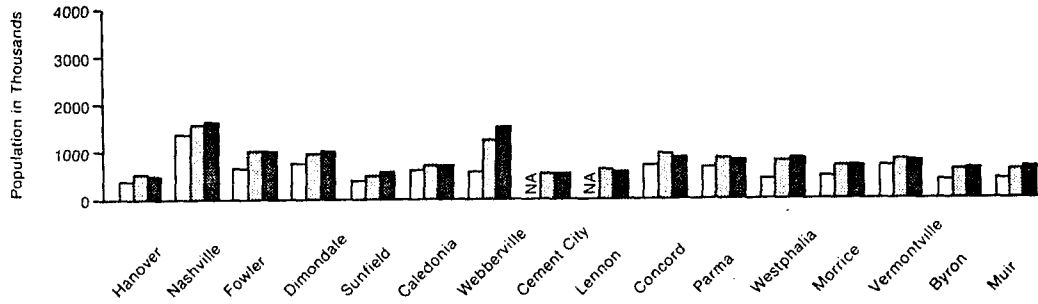
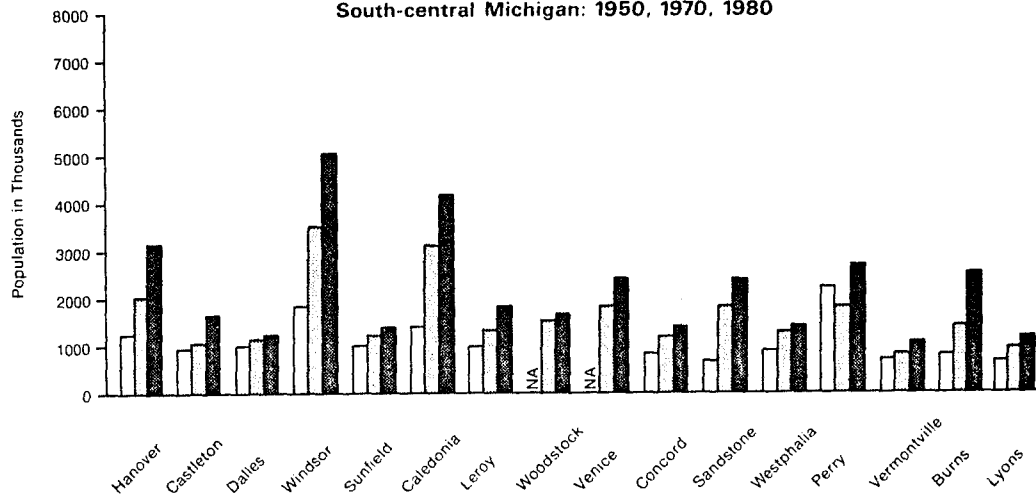


Figure 3.12a The population of central villages and their surrounding townships at three points in time.

Rural Village Population
South-central Michigan: 1950, 1970, 1980



Rural Farm and Non-Farm Population
South-central Michigan: 1950, 1970, 1980



Rural Township Population
South-central Michigan: 1950, 1970, 1980

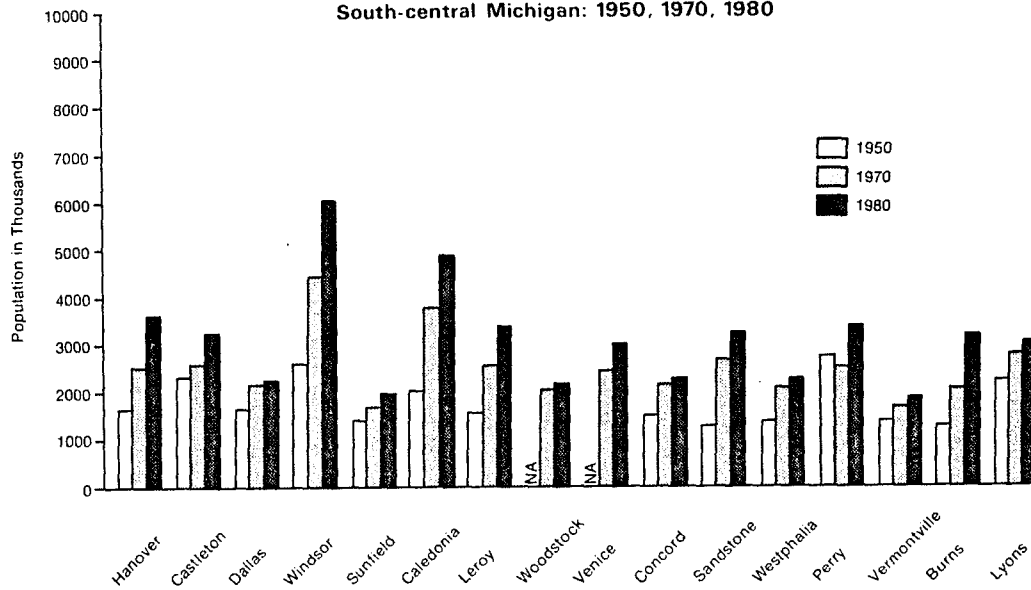
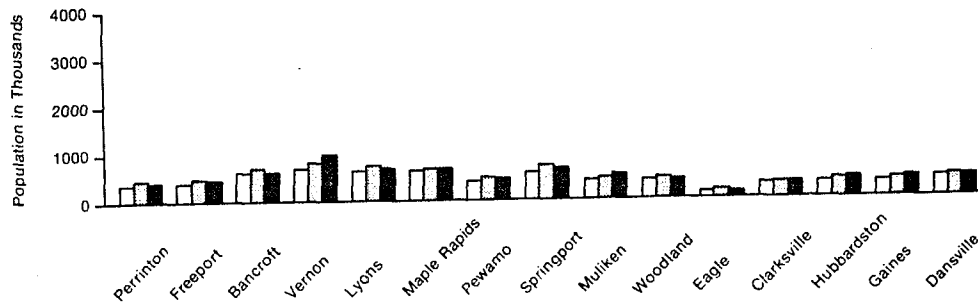
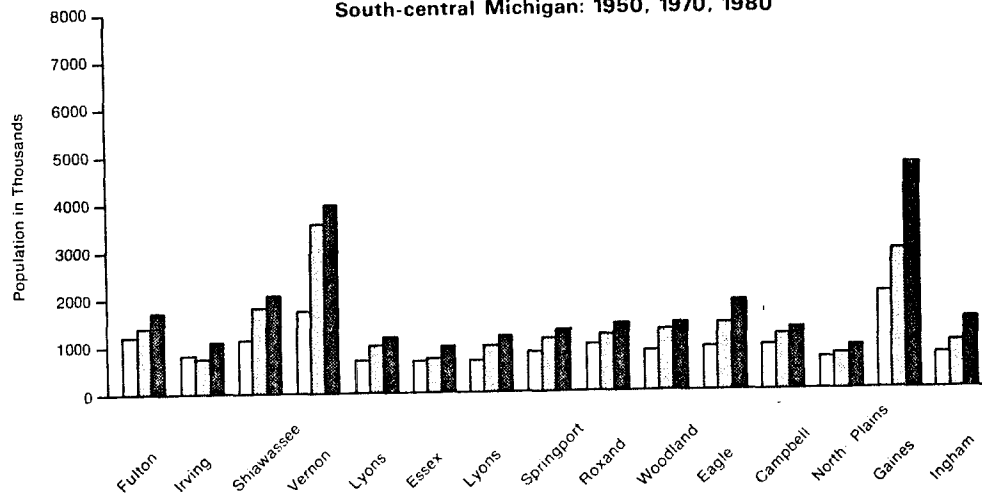


Figure 3.12b The population of central villages and their surrounding townships at three points in time.

Rural Village Population
South-central Michigan: 1950, 1970, 1980



Rural Farm and Non-Farm Population
South-central Michigan: 1950, 1970, 1980



Rural Township Population
South-central Michigan: 1950, 1970, 1980

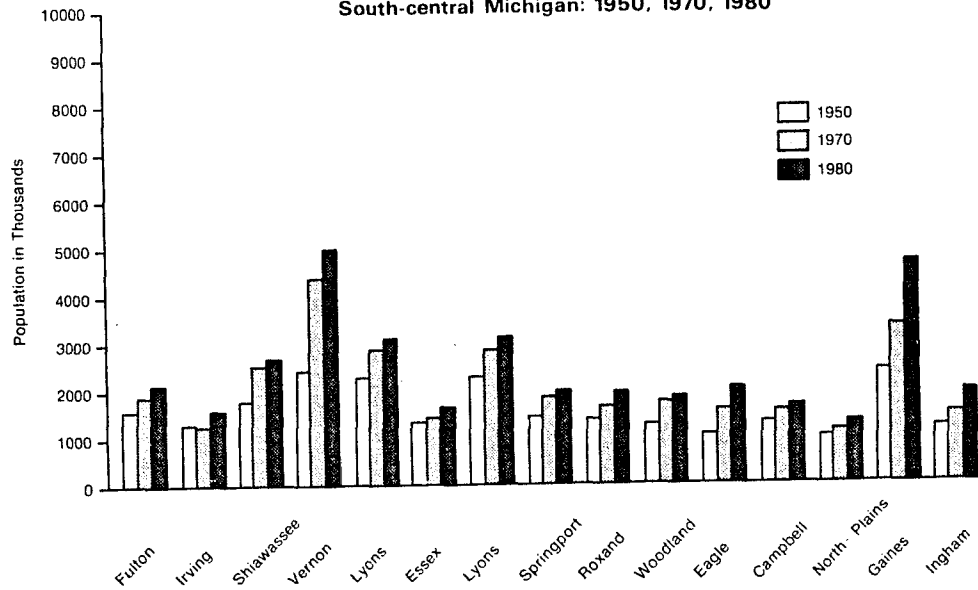


Figure 3.12c The population of central villages and their surrounding townships at three points in time.

Acres of Land in Farms per County Counties of South-central Michigan: 1950, 1969, 1978

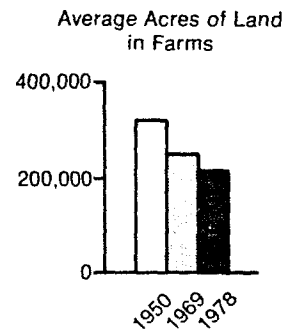
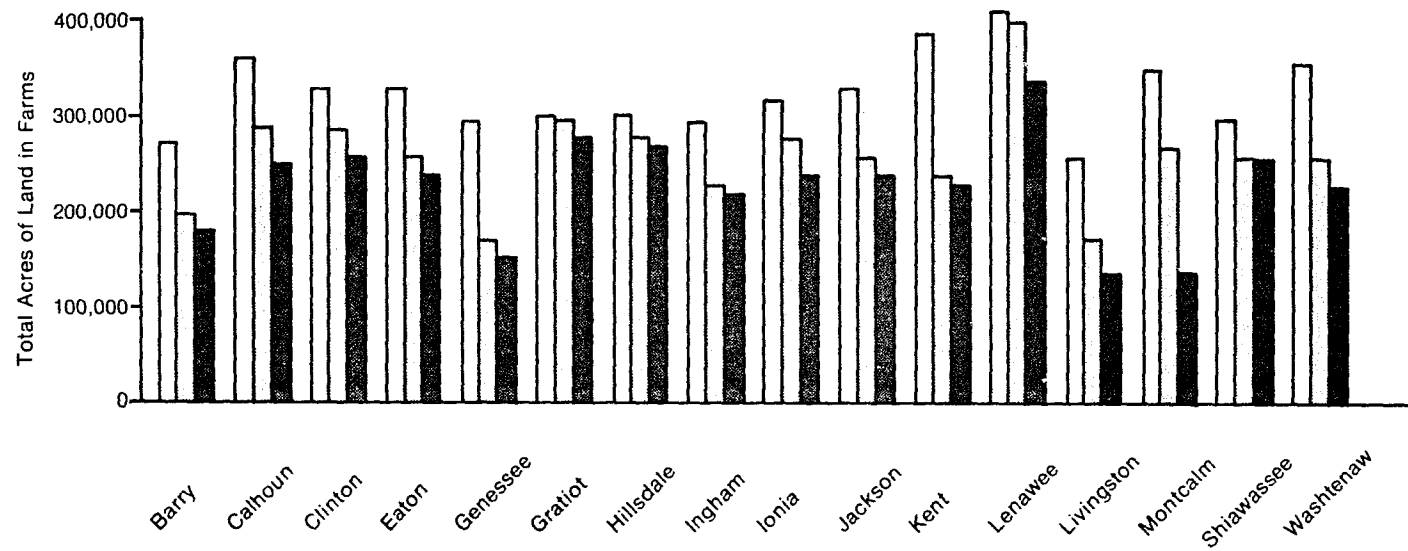


Figure 3.13 Total acres of land in farms by counties; and their average values in 16 counties of south-central Michigan. Data collected from the U.S. Census of Agriculture for 1950, 1969, and 1978.

U.S. in the 1970s (Fisher and Mitchelson, 1981:303, 304). It may be concluded that in the period of 1970 to 1980 rural areas became more attractive and gained population at a greater rate than their urban counterparts. Most of the nonfarm families of the study area had established their homes in the rural landscape since 1968, and the majority of such residents commuted to jobs in the Detroit area, Flint, Lansing, and East Lansing, Grand Rapids, Battle Creek, Jackson, Ann Arbor and Ypsilanti. Employment in the auto industry (General Motors, Ford, Oldsmobile) and related industries, government and secretarial work, professional employment, private businesses, and retirement were the typical ways of life among these rural nonfarm families. Reasons mentioned by the respondents for choosing life in the countryside were the advantages of having greater space and a quiet peaceful atmosphere, proximity to work and lower living costs. Other nonfarm respondents mentioned being native to their rural communities.

The increased popularity of living in the rural areas favored significant rural housing development in the villages surveyed. Housing development within or near the limits of some of the villages was started in the mid-1960s and continued to develop in 1970s in the most of central villages. Apartments, condominiums and mobile homes were typical features of rural housing development in the study area. In the farm landscape, the subdivision of farms for

new housing tracts, and some industrial and commercial uses, showed the influence of the increased population of nonfarm people and decrease of farm families over the last decade.

All of the sampled rural townships of the study area gained population in the period from 1970 to 1980 (Figure 3.12) which demonstrates the increased popularity of rural living. In the case of central villages, 65 percent of them gained population and 35 percent lost population from 1970 to 1980 (Figure 3.12). The depopulation of high order villages, including Chelsea, Brooklyn and Dexter in the 1970s was related to the economic problems of the auto industries in Detroit and Lansing that caused unemployment among autoworkers. Unemployed autoworkers who lived in these villages tended to leave the area for jobs in other places. In the case of smaller villages, depopulation in the 1970s may have been related to less expensive housing opportunities in the farm landscape than in central villages. Continued decline in the number of farms and conversion of farmlands for residential purposes caused farm acreage to decrease 8.2 percent in the 1970-1990 period (Figure 3.13).

The recreational activities and attractions of the rural areas' peaceful environment in addition to regional transport development encouraged the increase of rural population particularly since the early 1970s (for related information see McCarthy and Morrison, 1977; Hodge and Whitby, 1981; and Johansen and Fuguitt, 1973). At the time of the

study, 61 percent of the central village of the study area had been engaged in developing recreational facilities for camping and boating, tourist facilities and/or parks over the past decade. Some tourism and recreational functions (stores) had also emerged in the central villages due to the increasing importance of leisure time activities.

In the case of specialized housing for retired persons, some of the village, like Lake Odessa, Saranac, Nashville, and Hanover, have stressed the addition of such housing over the past 10-15 years and created attractive housing and mobile home development for retirees. It should be noted that rural housing development (in the 1970s and early 1980s) in the study area villages has also attracted young, and low income couples, many of whom live in Ovid, Maple Rapids, and Dimondale. Highway development and cheaper rural living costs have favored this population distribution.

Another consequence of rural development in south-central Michigan has been the emergence and increase of part-time farming. According to Clout (1977:478) urban hobby farmers have purchased land as a good investment and because it provides a better living environment. As mentioned before, 45.3 percent of farmers in southcentral Michigan are part-time farmers; some of them are hobby farmers. The influence of hobby farming on the central village functions, could be seen in the increased number of

farm and garden machinery and supplies vendors, from six stores in 1970 to twenty-five stores in 1980.

In conclusion, rural development in southcentral Michigan has brought a declining number of operating farms and farm depopulation, but also resulted in a pattern of rural re-population that has brought many nonfarm families and some industry to the rural landscape of the study area. Changes in the spatial distribution of villages, due to the changes in their functional viability, have been associated with this rural development and will be discussed later in this research.

CHAPTER FOUR
SOCIOECONOMIC MODELING OF CENTRAL VILLAGES:
FUNCTIONAL AND STRUCTURAL

Functional Modeling

Since the purpose of this research was the comparative analysis of central villages in time and space, a classification method was necessary for grouping the central villages studied at three points in time. The "functional index classification" method, which is an objective means of grouping central places in their hierarchical structure, was chosen for this purpose. It was also helpful for determining the hierarchical order of functions in the sampled central places, as well as the rank order and the location coefficient of each individual function. The functional index classification provided a means for visualizing the spatial distribution of different types of functions and the frequency of their occurrence in the central places of a study region in any particular time period. The classification thus aided the comparative analysis of general and individual functional changes of central places over time.

Functional index classification was devised by Davies (1967), whose work provided impetus for the empirical work of Marshall (1969) and O'Farrell (1969) and the theoretical

work of Bennison (1978). Davies found perfect hierarchical groups among 51 central places distributed along a valley in England (satellite centers of Pontypridd). Marshall (1969) found imperfectly grouped hierarchies among two systems of central places in southern Ontario in Canada. O'Farrell (1969), in his empirical study of central places in County Tipperary (Ireland), also found a tendency toward grouping in his data. It should be noted that Davies, Marshall, and O'Farrell all applied functional index classification in grouping central place functions, and found this method to be practical and objective, that is, reliable and testable.

To compute the functional index, the location coefficient of each function should be calculated, using $C=100.t/T$ where t is one functional unit of certain function. For instance, function A has five functional units (stores) in central place #1 and three functional units in central place #2 (Table 4.1). T is the total functional units or the total number of stores of a certain function among all the central places. For instance, there are 25 (total) functional units of function A in Table 4.1, 20 of function B, etc. Finally, "C" is the location coefficient for the examined functions. Thus, the location coefficient of function A (Table 4.1) is calculated: $C = 100.1/25 = 4$. The same calculation yields 5 for function B, 10 for function C, 20 for function D and 50 for function E (Table 4.1).

TABLE 4.1: A Hypothetical Model of Functional Index Classification

Central Places	Types of Functions				
	A	B	C	D	E
1	5	4	2	1	1
2	3	3	1	1	1
3	3	2	1	1	
4	2	2	1	1	
5	1	2	1	1	
6	2	2	2		
7	3	2	1		
8	3	1	1		
9	2	1			
10	1	1			
Total					
Functional					
Units:	25	20	10	5	2
Location					
Coef-					
ficients:	4	5	10	20	50
C=100.t/T					

Central Places	Types of Functions					Functional Indexes*	
	A	B	C	D	E		
1	20	20	20	20	50	130	Class I
2	12	15	10	20	50	107	
3	12	10	10	20		52	Class II
4	8	10	10	20		48	
5	4	10	10	20		44	
6	8	10	20			38	
7	12	10	10			32	
8	12	5	10			27	Class III
9	8	5				13	
10	4	5				9	
<u>Total</u> <u>Central-</u> <u>ity:</u>						500	

*Functional indexes have been classified into three groups using Jenks method. Then an F-test was applied to determine the significance of this classification. $H_0: \mu_1, \mu_2, \mu_3$. $H_1: \mu_1, \mu_2$, and μ_3 are different.

$$F = \frac{MS \text{ between}}{MS \text{ Within}} = \frac{SS \text{ Between}/(J-1)}{SS \text{ Within}/(N-J)} = \frac{13893.15/(3-1)}{695.97/(10-3)} = 69.87;$$

df of MS between: 2 and df of MS within : 7; calculated F value: 69.87 is greater than the critical F value of 9.55 at $p = .01$. Therefore, the null hypothesis is rejected and we accept the alternative hypotheses that implies significant difference of means.

In order to learn the functional indexes of the hypothetical model (Table 4.1), the centrality of each individual function in a certain central place is computed. For this purpose, the functional units of a particular function are multiplied by its designated location coefficient. Thus, the centrality of function A at central place #1 has been calculated by multiplying its 5 functional units by its location coefficient of 4, yielding 20 as the centrality of function A at central place #1. The calculated centrality for functions B, C, D and E in central place #1 is 20, 20, 20 and 50, respectively (Table 4.1). Summing all these centrality values for functions A, B, C, D, and E yields 130, which is the functional index for central place #1. Other functional indexes are calculated the same way for the rest of the central places in Table 4.1. It should be noted that the summation of all the centrality values for a function among the central places studied, will be 100. For instance, the total centrality of function A among all ten central places is 100. Functions B, C, D and E, thus have 100 values of centrality. The summation of total centralities of each function, will be the same amount as the summation of functional indexes calculated for each central place.

The Jenks method of classification that is based on variations of observations from the mean (less variance within the groups and higher variance between the groups)

was used for classifying the computed functional indexes in this research. To confirm the Jenks classification of functional indexes, analysis of variances and F-tests (tests of significance for the results of analysis of variance) have been used. Such a verified classification was essential for explaining and generalizing similarities among variables within each class of central places and general differences between the classes. Table 4.1 shows the procedure for calculating the functional index classification and applied F-test (analysis of variance).

The functional classification of the data of this research at three points in time are shown in Appendix Tables A.1, A.2 and A.3. The selected functions are central place-oriented and include wholesale and retail sales and services in the central villages. The data were derived from the Dun and Bradstreet, Reference Books (1950, 1970 and 1980) and the Telephone Directories of towns and cities of south-central Michigan (1969-1971 and 1979-1982) for the 46 central village studied. The central functions in 1950 are shown by trade symbols (See Table A.1). For 1970 and 1980 they are depicted by Standard Industrial Classification numbers as they are printed in the Dun and Bradstreet, Reference Book.

Table A.1 does not include the rural services shown in Tables A.2 and A.3 because it was not possible to distinguish the rural services related to a particular central

place from the 1950 Telephone Directories. Therefore, all the central functions attributed to 1950 in Table A.1 were derived data from Dun and Bradstreet, Reference Book for 1950 (wholesale and retail sales functions).

Location coefficients (L.C.) of each central function and the functional index values for each central village are also shown in Tables A.1, A.2 and A.3. These functional index values were grouped by the Jenks method of classification (using a computer) and the results of the classification were tested by analysis of variance (F-test). The F-test procedures for the final steps of the functional classifications (1950, 1970 and 1980) are shown in Tables 4.2, 4.3 and 4.4. The results of the F-tests suggest a significant statistical verification of each classification of central villages (1950, 1970 and 1980).

In order to show the combined picture of central village classification according to the order of their functional index values and their designated classes in 1950, 1970 and 1980, Table 4.5 has been prepared. To visualize the spatial distribution of each class of central villages at the three points in time (1950, 1970, 1980), Figures 4.1, 4.2 and 4.3 are provided. These figures are used later in this research to explain the change in the viability and spatial distribution of the central villages studied.

Table 4.2: Hierarchical Orders of Central Villages in 1950

Villages in Order	Number of Observations	Range of Functional Index Values
First Order Villages	1	983.70 - 983.70
Second Order Villages	1	656.56 - 656.56
Third Order Villages	7	484.14 - 379.18
Fourth Order Villages	6	350.53 - 251.88
Fifth Order Villages	11	281.61 - 129.03
Sixth Order Villages	20	103.98 - 11.25

Therefore: $SSW = 41516.40$; $df: 46-6=40$; $MSW = 1037.91$
 $SSB = 3,945,951$; $df: 6-1=5$; $MSB = 789192.24$

F-Test: $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H_1 : The means of these six groups of central villages are different from each other. Villages have hierarchical orders.

Critical Value of F: 99% is 3.51

Calculated F Value is: $\frac{MSB}{MSW} = \frac{789192.24}{1037.91} = 760.36$

Conclusion: The calculated F-value is significantly greater than the critical F-value; therefore, H_0 is rejected and H_1 is accepted. This means that the six orders or classes of villages have different means, that differences between classes existed.

Table 4.3: Hierarchical Order of Central Villages in 1970

Villages in Order	Number of Observations	Range of Functional Index Values
First Order Villages	3	884.66 - 792.87
Second Order Villages	4	675.66 - 604.84
Third Order Villages	5	517.26 - 381.93
Fourth Order Villages	7	296.06 - 183.42
Fifth Order Villages	12	157.77 - 77.50
Sixth Order Villages	15	66.76 - 9.75

Therefore: $SSW = 41986.94$; $df: 46-6=40$; $MSW=1049.6735$
 $SSB = 3759839.5$; $df: 6-1=5$; $MSB=751967.9$

F-Test: $H_0: \mu_1=\mu_2=\mu_3=\mu_4=\mu_5=\mu_6$

H_1 : The means of these six groups of central villages are different from each other. Villages have hierarchical orders.

Critical Value of $F=99\%$ is 3.51

Calculated value of F is: $\frac{MSB}{MSW} = \frac{751967.9}{1049.6735} = 716.38$

Conclusion: The calculated F -value is significantly greater than the critical F -value; therefore, H_0 is rejected and H_1 is accepted. This means that the six orders of villages have different means; that differences between the classes existed.

Table 4.4: Hierarchical Order of Central Villages in 1980

Villages In Order	Number of Observations	Range of Functional Index Values
First Order Villages	3	1024.45 - 986.53
Second Order Villages	7	615.25 - 458.00
Third Order Villages	4	377.21 - 360.68
Fourth Order Villages	6	305.61 - 221.86
Fifth Order Villages	8	188.13 - 114.48
Sixth Order Villages	18	93.33 - 14.41

Therefore: $SSW = 40908.3$; $df: 46-6=40$; $MSW = 1022.71$
 $SSB = 4000764.49$; $df: 6-1=5$; $MSB = 800152.9$

F-Test: $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H_1 : The means of these six groups of central villages are different from each other. Villages have hierarchical orders.

Critical value of F: 99% is 3.51

Calculated value of F is: $\frac{MSB}{MSW} = \frac{800152.9}{1022.71} = 782.38$

Conclusion: The calculated F-value is significantly greater than the critical F-value; therefore, H_0 is rejected and H_1 is accepted. This means that the six orders of villages have different means; that differences between the classes existed.

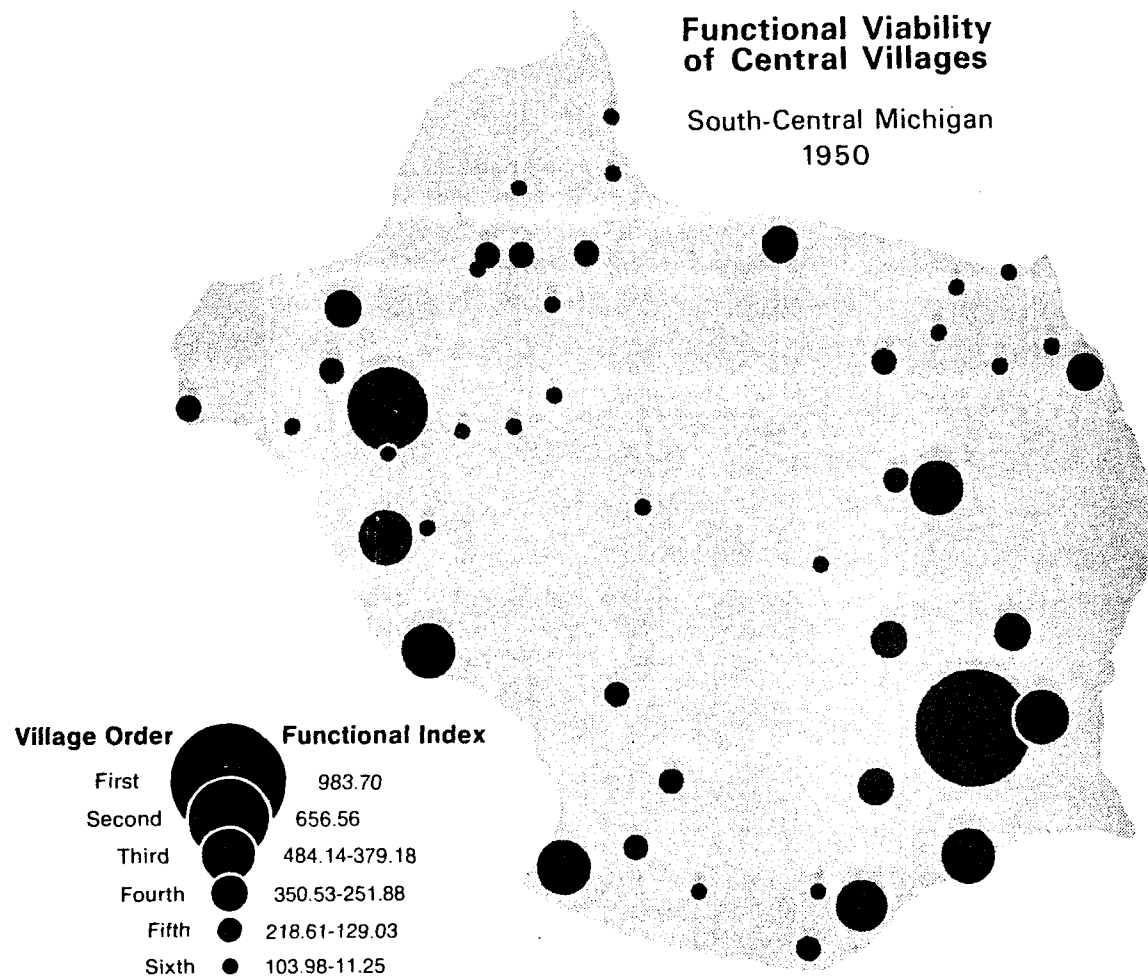


Fig. 4.1 Spatial distribution of different classes of central villages studied in 1950.

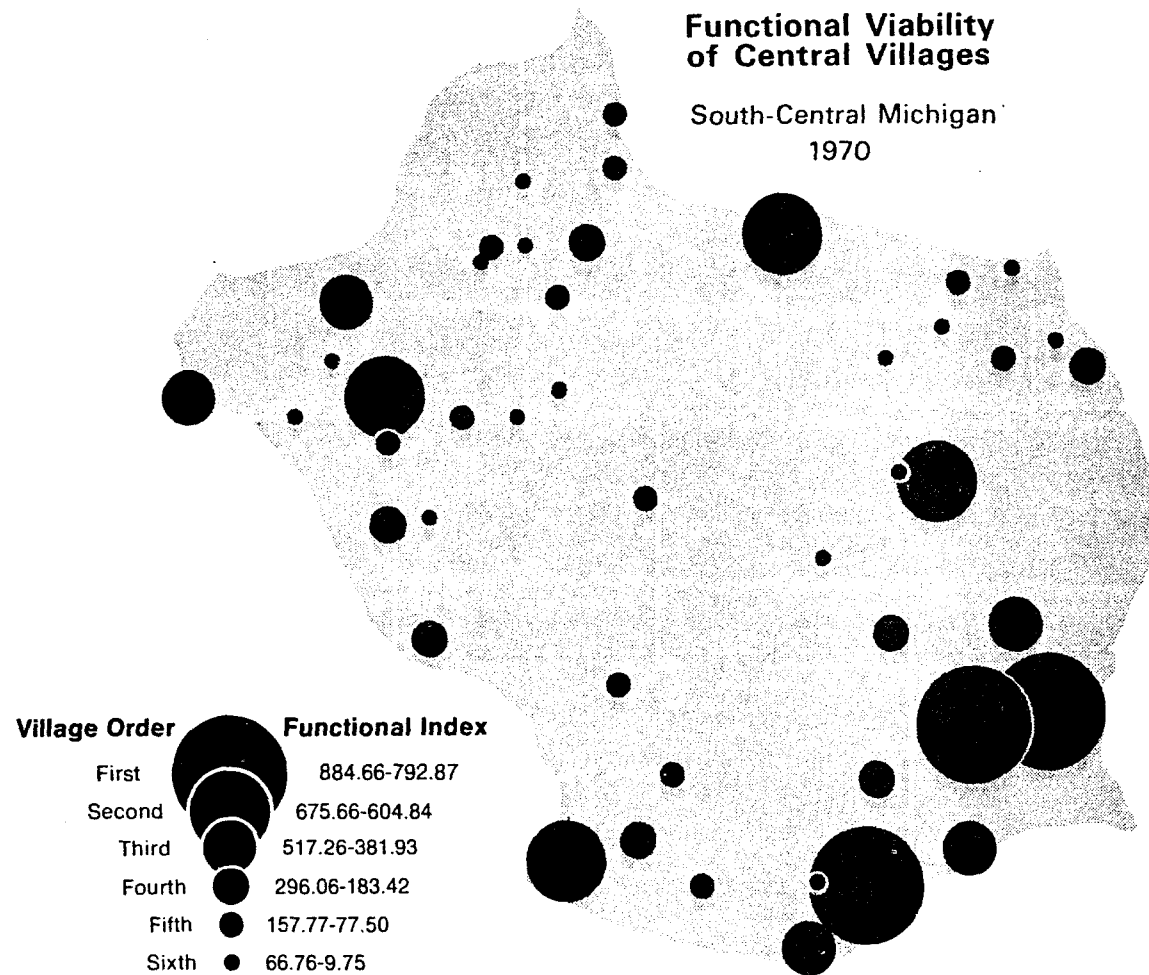


Fig. 4.2 Spatial distribution of different classes of central villages studied in 1970.

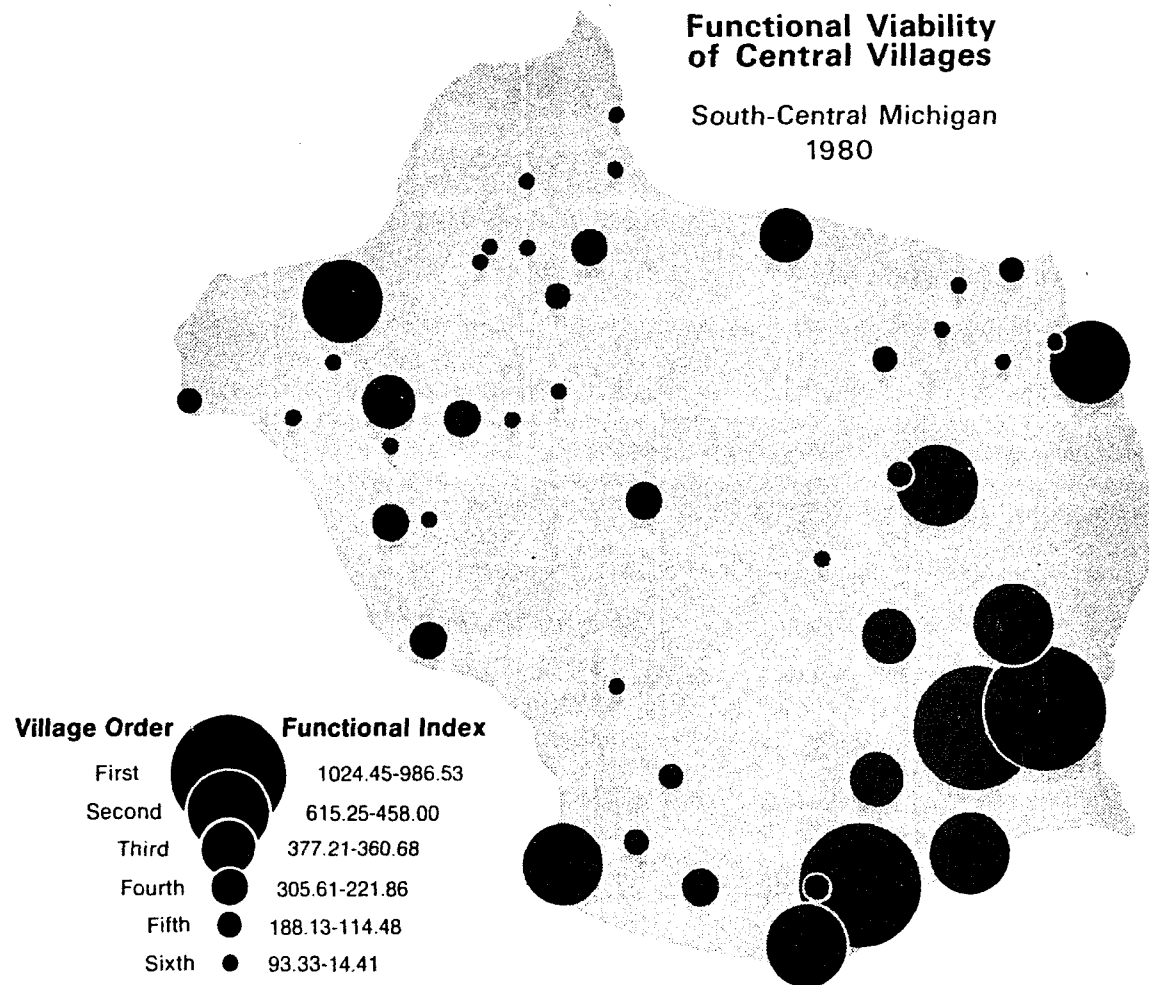


Fig. 4.3 Spatial distribution of different classes of central villages studied in 1980.

TABLE 4.5: Central Villages' Order According to Their Functional Viability in 1950, 1970 and 1980

1950 Central Village	Functional Index	1970 Central Village	Functional Index	1980 Central Village	Functional Index
1. Chelsea	983.70	1. Chelsea	884.66	1. Brooklyn	1024.45
2. Lake Odessa	656.56	2. Brooklyn	880.19	2. Dexter	1012.23
		3. Dexter	792.87	3. Chelsea	986.53
3. Dexter	484.14	4. Lake Odessa	675.66	4. Fowlerville	615.25
4. Fowlerville	455.70	5. Ovid	634.81	5. Saranac	563.19
5. Nashville	453.91	6. Homer	633.15	6. Manchester	519.41
6. Manchester	431.31	7. Fowlerville	604.84	7. Linden	515.13
7. Brooklyn	389.24			8. Pinckney	484.33
8. Bellevue	384.09	8. Addison	517.26	9. Homer	465.47
9. Homer	379.18	9. Manchester	425.60	10. Addison	458.00
		10. Saranac	421.12		
10. Stockbridge	350.53	11. Pinckney	382.30	11. Stockbridge	377.21
11. Linden	299.46	12. Caledonia	381.93	12. Grass Lake	374.92
12. Grass Lake	298.86			13. Ovid	369.57
13. Pinckney	291.56	13. Linden	296.06	14. Lake Odessa	360.68
14. Saranac	279.06	14. Stockbridge	291.07		
15. Ovid	251.88	15. Nashville	239.74	15. Bellevue	305.61
		16. Concord	237.17	16. Hanover	290.84
16. Webberville	218.61	17. Grass Lake	232.12	17. Nashville	257.45
17. Fowler	206.96	18. Fowler	206.40	18. Fowler	249.11
18. Parma	195.45	19. Bellevue	183.42	19. Dimondale	225.94
19. Pewamo	192.19			20. Sunfield	221.86
20. Springport	187.18	20. Parma	157.77		
21. Caledonia	174.53	21. Dimondale	143.17	21. Caledonia	188.13
22. Addison	153.12	22. Woodland	125.26	22. Webberville	187.51
23. Muir	145.26	23. Byron	117.65	23. Cement City	173.43
24. Concord	132.51	24. Westphalia	111.20	24. Lennon	152.17
25. Morrice	131.59	25. Vernon	105.38	25. Concord	151.05
26. Clarksville	129.03	26. Muri	90.22	26. Parma	144.43
		27. Hanover	87.28	27. Westphalia	144.12
27. Vermontville	103.98	28. Sunfield	84.43	28. Morrice	114.48
28. Byron	103.06	29. Maple Rapids	80.02		
29. Lennon	100.81	30. Perrinton	78.74	29. Vermontville	93.33
30. Dimondale	90.86	31. Springport	77.50	30. Byron	86.41
31. Maple Rapids	87.67			31. Muir	81.66
32. Sunfield	83.22	32. Webberville	66.76	32. Perrinton	69.30
33. Woodland	79.06	33. Freeport	61.66	33. Freeport	51.46
34. Bancroft	76.93	34. Bancroft	60.46	34. Bancroft	51.21
35. Muliken	73.80	35. Lennon	51.94	35. Vernon	41.12
36. Westphalia	69.36	36. Cement City	51.77	36. Lyons	40.66
37. Gaines	60.56	37. Vermontville	50.45	37. Maple Rapids	36.02
38. Vernon	60.42	38. Morrice	47.10	38. Pewamo	35.57
39. Hanover	59.83	39. Clarksville	39.32	39. Springport	35.34
40. Freeport	55.21	40. Pewamo	38.31	40. Muliken	34.66
41. Lyons	44.92	41. Muliken	37.21	41. Woodland	27.48
42. Dansville	37.00	42. Hubbardston	35.13	42. Eagle	17.07
43. Perrinton	26.51	43. Eagle	27.06	43. Clarksville	16.46
44. Hubbardston	25.09	44. Dansville	24.33	44. Hubbardston	16.43
45. Cement City	22.70	45. Gaines	18.23	45. Gaines	15.41
46. Eagle	11.25	46. Lyons	9.75	46. Dansville	14.41

SOURCE: Derived from Tables 4.2, 4.3, 4.4 and A.1, A.2 and A.3.

Structural Modeling

The relationship of population and function in the central places of a study area may be visualized and examined through both continuous and discontinuous models (see O'Farrell, 1969 and Rowley, 1971). In this study, both models have been used. The hierarchical grouping of central villages in six classes provides a smaller number of observations in correlation and regression tests of the relationship of population and function in every class (discontinuous model). To provide complementary results, all 46 central villages are also examined in a continuous model of population and function relationship.

Continuous Models Of Population and Function Relationship

In order to test the hypothesis concerning the relationship between population size (served) and the functional range¹³ or numbers of functions of central villages (using the central functions of retail and wholesale activities), a correlation test and a regression analysis were

13

Functional range is equivalent to the number of functions in central places of a study area (See Haggett, 1977:140). In fact, it refers to the total numbers of different types of functions offered in a central place. For instance, central place #1 (in Table 4.1) has a functional range of 5 (having functions A, B, C, D and E), while central place #10 has a functional range of 2 (having only the two functions of A and B).

applied in this research. The application of correlation analysis shows the variation of population size in relationship to the variation of the number of functions of central villages. Comparing the calculated correlation coefficients for those two variables (population and function) at three points of time in the study area is helpful in justifying the variations in their relationships. In related empirical studies, correlation coefficients (Stafford, 1963 and Johansen and Fuguitt, 1973) were used to describe the relationship of population size and number of functions. Therefore, in testing this notion empirically the Pearson Product Moment (correlation coefficient) has been used in this research (the correlation coefficient with related tests of significance are discussed in Bacon, 1976; Taylor, 1977 and Till, 1974). For determining the linear relationship between population size (served) and functional range (numbers of functions) of central villages in the study area at three points of time, the parametric statistical method of simple linear regression was used. This method was applied in the work of Johansen and Fuguitt (1984) on American villages for determining the linear relationship between any village's population and its economic activities. Simple linear regression (See Bacon, 1976; Taylor, 1977 and Till, 1974) provides a continuous model of population and function relationship among the central villages of the study area. Comparison of the related regression coefficients'

variations at three points of time helps to explain this linear relationship.

Arranging the variable of population size (served) of villages and their surrounding townships on the x axis, and the variable of numbers of functions (functional range) on the y axis, the Pearson's "r" was .901 in 1950, .821 in 1970 and .782 in 1980 (Figure 4.4). The significance level of calculated "r" at .00001, showed that the statistically significant relationships existed between the two variables in all three examinations. The important point is that a strong relationship existed between populations and functions of villages at the three points in time as demonstrated by high correlation coefficients (Figure 4.4). Decline in "r" values from 1950-1980 meant that the population size of the villages accounted for the greatest proportion of variation in their numbers of functions in 1950. This covariation was reduced in 1970 and 1980 implying that the variation in village populations was more closely correlated with variation of functions in 1950 than in 1970 and 1980. Figure 4.4 is presented to explain the linear relationship between population and function of central villages in a continuous model. In the figure, the number of functions of central villages, the dependent variable (on the y axis), and the populations of the villages (in logarithmic scale), the independent variable (on the x axis), were tested for linear relationship at the three points of time.

**Number of Functions and Population Size
Central Villages, South-central Michigan
1950, 1970, 1980**

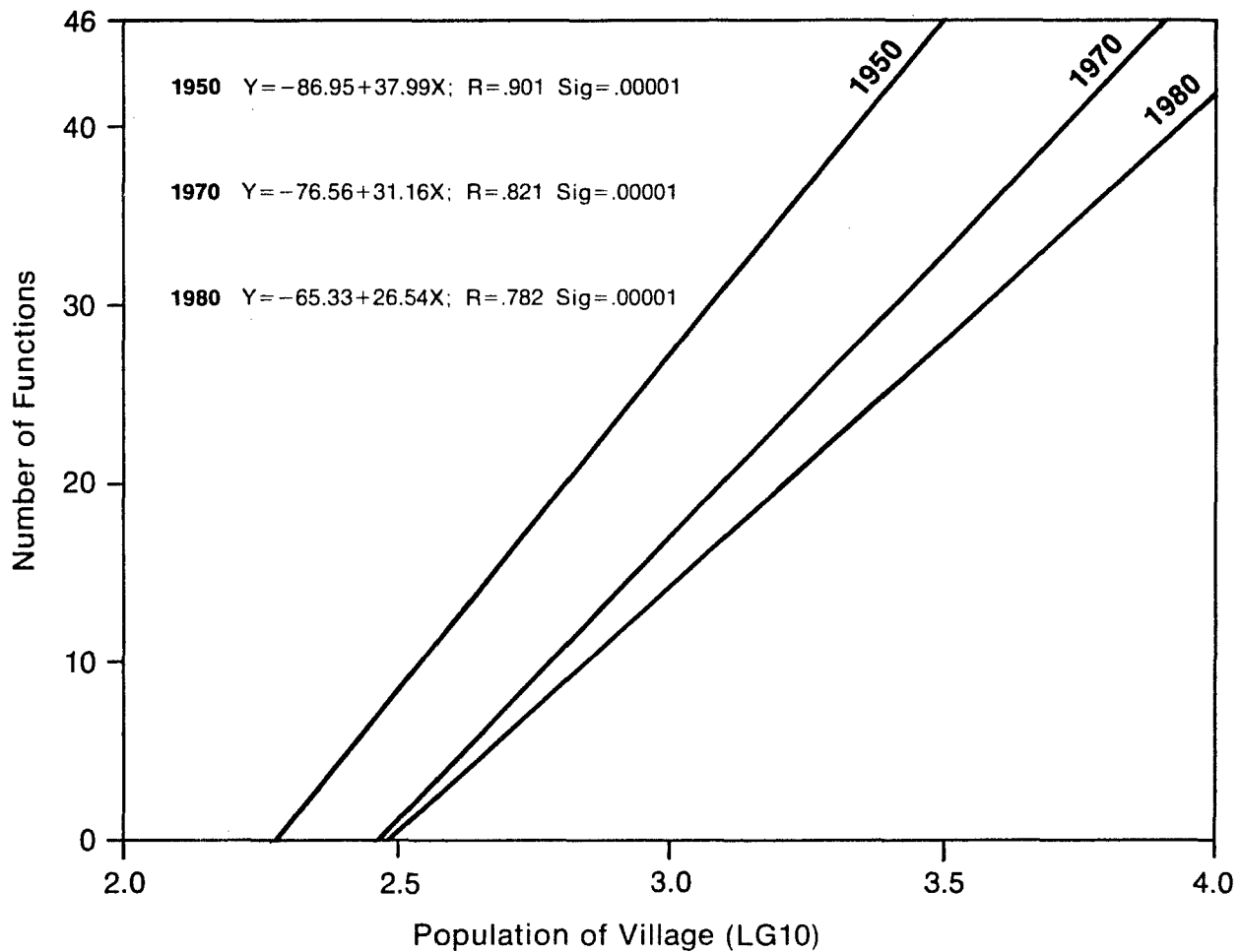


Fig. 4.4 The continuous linear relationships between the central village' functional range (number of functions) and their population size at three points of time.

The positive regression coefficients between the two variables of function and population in central villllages in 1950, 1970 and 1980 were consistent with the rank size rule of central place theory. The gradual decline of the regression coefficients across three points of time in the study area (Figure 4.4) meant that the rate of change in the number of functions in central villages per unit of population size was greatest in 1950 and decreased in 1970 and 1980. Thus, the population size of villages was a stronger determining factor for change in the number of functions in central villages in 1950 than in 1970 and 1980.

The direction of the regression lines shows a positive relationship between population and function at all three points of time (Figure 4.4). The shifts in regression lines to the right and downward for the later years indicated generally that the number of functions in central villages declined, although the population of those villages increased. The continuous model constructed to show the relationship between population served (township population) and numbers of functions in central villages (Figure 4.5) found the same pattern and explanation. Because townships contain larger populations than central villages (Figure 3.12), the regression lines have shifted even farther to the right. Thus, the greater populations (in the townships) and the same range of functions (as that examined for the villages) resulted in the changes in the regression lines

**Number of Functions and Population Served
Townships, South-central Michigan
1950, 1970, 1980**

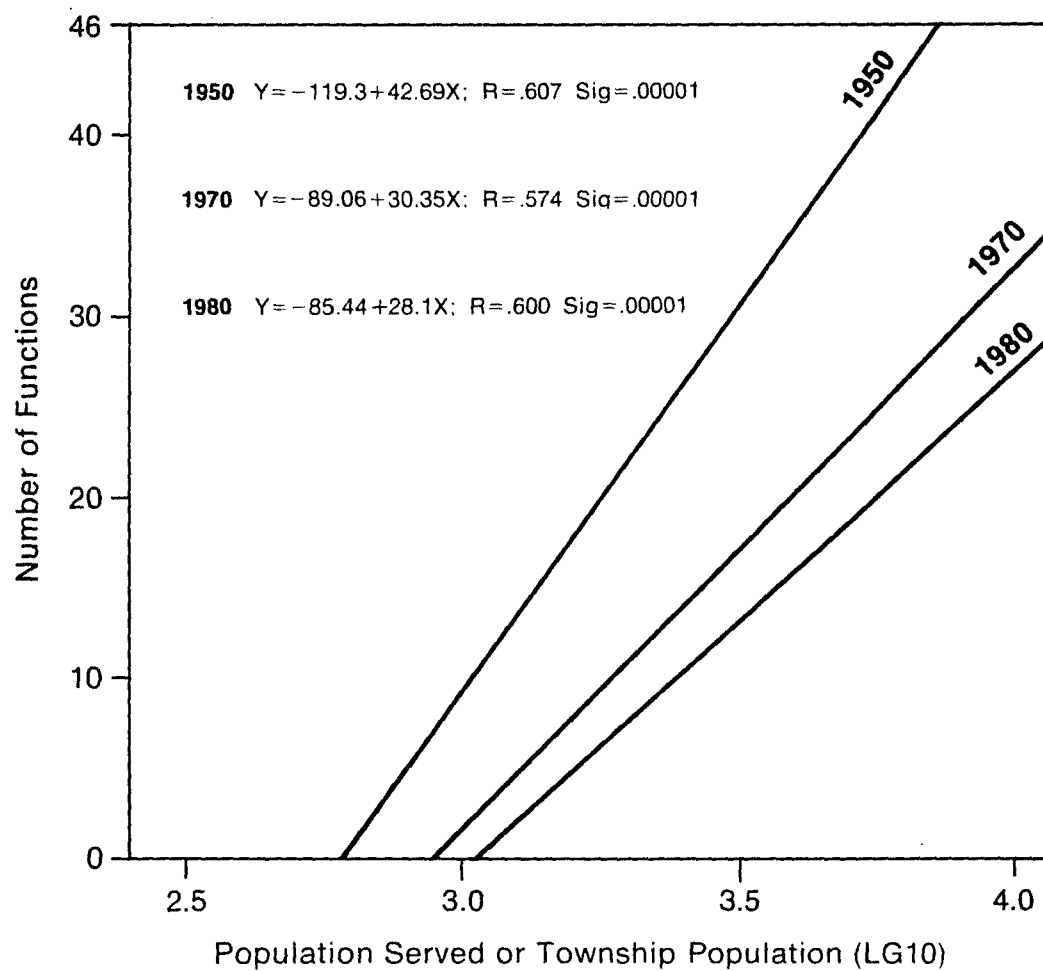


Fig. 4.5 The continuous linear relationships between functional range (number of functions offered in central villages) and population served (population of townships) at three points of time.

shown in Figure 4.5. Tests of this relationship also showed a strong correlation ($r=.607$ for 1950; $r=.574$ for 1970 and $r=.600$ for 1980) at the .00001 significance level.

To conclude, it may be said that due to the strong relationship between population and the number of functions of central villages, changes in the central villages' viability have been associated with population changes in these villages and their surrounding townships. Agricultural industrialization and super highway development (discussed in Chapter Three) have tended to depopulate farms and increase the number of nonfarm families on the rural landscape of the study area. This has been accompanied by functional changes in central villages that have greatly decreased the numbers of their functions and establishments (the total number of shops, stores and services in a village) over the study time and periods (discussed in detail in Chapter Five). Therefore, agriculturally-oriented functions declined in favor of emergency of more nonagricultural functions (residential and recreational) that are responsive to demands of the changing population of rural landscape.

The continuous model of relationship between population and functions, using log linear regression analysis, has been applied by Berry and Garrison (1958), Foust and de-Souza (1978) and Johansen and Fuguitt (1984) to predict the

required (threshold) population for the survival of a given function in the United States. Berry and Garrison's (1958) basic model for predicting the threshold population for a function, considers population on the y axis (dependent variable) and number of functional units (establishments) of a certain function on the x axis (independent variable). The model equation is $P = A (B)^N$, where P is the threshold population required for establishing one establishment (store) of a certain function in a central place, and N is one establishment (store) of that certain function. For the second and nth establishment of that function, N will be equal to 2 and n. A and B values are parameters that are calculated in a simple regression test by using the population size of villages and the number of establishments of a certain function in those villages.

The threshold population calculated for a certain function by Berry and Garrison (1958) and Foust and deSouza (1978) was done for all the central places of a region (not merely for villages) at one point in time. Johansen and Fuguitt's (1984) work, however, deals with American villages in a dynamic approach over the years 1950-1970. Therefore, the results of their work provide better criteria for comparison with the results of this research. According to Johansen and Fuguitt, the threshold population for functions such as grocery and paint and wallpaper stores increased between 1950 and 1970 in American villages. The

same trend appears for these functions in the study area for this research. For instance, the threshold population for establishing one grocery store in each central village of southcentral Michigan was 489 in 1950, 659 in 1970 and 761 in 1980; for a paint and wallpaper store it was 708 in 1950, 770 in 1970 and 1,231 in 1980. The reason for the increase in threshold population was related to highway and super highway development in the region which afforded regional accessibility to the residents of this area. Thus, people have greater mobility and are able to go greater distances for shopping.

Tables 4.6 and 4.7 show the calculated threshold populations for one establishment of each sampled function (in the field survey) for 1950, 1970 and 1980. To compute the threshold population for establishing the first grocery store in each central village of the study area (in 1950), the A and B values were first derived from a logarithmic regression analysis which yielded 2.60315 as the A value and .08612 as the B value. These were then converted to their antilogarithmic values (401 and 1.22, respectively) and then applied to the threshold formula, $P = A(B)^{\frac{N}{1}}$ = 401 (1.22) = 489. Thus, the threshold population for a grocery store at the village level was 489 persons in 1950.

According to Tables 4.6 and 4.7, generally the threshold population for one establishment or one functional unit of a certain function increased from 1950 to 1970 and from

TABLE 4.6: Threshold Population for Sampled Functions (Village Level) for 1950, 1970 and 1980

Central Functions	1950*	1970	1980
	Threshold Population	Threshold Population	Threshold Population
Grocery Store	489	659	761
Jewelry Store	946	1418	1228
Family Clothing	945	830	1415
Paint & Wallpaper Store	708	770	1231
Department Store	1654	1332	1918
Shoe Store	1750	935	896
Optometrist	NA	871	1355
Clinic	NA	3858	1424
Floor Covering Store	NA	921	973
Automotive Dealers	NA	1650	1092

*Data for rural services in 1950 marked "NA" was not available from the telephone directories for the study area in 1950.

TABLE 4.7: Threshold Population for Sampled Functions
(Township Level) for 1950, 1970 and 1980

Central Functions	1950* Threshold Population	1970 Threshold Population	1980 Threshold Population
Grocery Store	1668	2270	2862
Jewelry Store	2121	3594	4119
Family Clothing	2076	2162	3157
Paint & Wallpaper Store	1961	3357	4516
Department Store	2651	3377	5056
Shoe Store	2623	2846	2350
Optometrist	NA	1355	3577
Clinic	NA	5086	4234
Floor Covering Store	NA	3354	3782
Automotive Dealers	NA	3017	3377

*Data for rural services in 1950 marked "NA" was not available from the telephone directories for the study area in 1950.

1970 to 1980. It appears, therefore, that in the past (1950), due to the dominance of the local economy, the people of the hinterlands (farm families) were more supportive of the central functions offered in the local market (central villages). Therefore, a local function was able to survive with a proportionately smaller population patronizing that small local market. Regional development in southcentral Michigan, particularly from 1950 to 1970, however, provided greater mobility for the people who lived in the rural landscape of the study area. As a result, some local functions declined or disappeared and the survival of other local functions was in doubt because of their competitive interaction with facilities in higher order and larger central places of the region, particularly urban centers. Thus, some central functions available in lower order central villages, with smaller populations, declined or completely disappeared from those centers and became stable or increased in the higher order central villages which had greater threshold populations to support those functions.

The distribution of grocery stores, one of the lowest order central functions available in the villages, was reduced dramatically in frequency in third, fourth, fifth and sixth order villages (Table 4.8) in both periods of the study. Consequently, the threshold population for grocery

TABLE 4.8: Some Services Offered in the Central Villages of Southcentral Michgair, 1950, 1970 and 1980

Types of Services (Functions)	Functional Units (N)	Location Coefficient LC=1/N.100	First Order Villages N* Ave.**	Second Order Villages N Ave.	Third Order Villages N Ave.	Fourth Order Villages N Ave.	Fifth Order Villages N Ave.	Sixth Order Villages N Ave.
1950:								
Grocery Stores	116	0.86	9 9.00	4 4.00	24 3.00	19 3.40	25 4.20	35 1.75
Family Clothing Stores	2	50.00	0 0.00	0 0.00	2 0.29	0 0.00	0 0.00	0 0.00
Paint & Wall-paper Stores	9	11.11	1 1.00	0 0.00	2 0.29	1 0.17	2 0.18	3 0.15
Department Stores	3	33.33	1 1.00	1 1.00	0 0.00	1 0.17	0 0.00	0 0.00
Shoe Stores	3	33.33	1 1.00	1 1.00	1 0.14	0 0.00	0 0.00	0 0.00
1970:								
Grocery Stores	93	1.08	15 5.00	13 3.25	14 2.80	17 2.43	16 1.33	18 1.20
Family Clothing Stores	4	25.00	0 0.00	1 0.25	0 0.00	1 0.14	1 0.08	1 0.07
Paint & Wallpaper Stores	2	50.00	0 0.00	0 0.00	0 0.00	1 0.14	1 0.08	0 0.00
Department Stores	6	16.67	3 1.00	1 0.25	0 0.00	2 0.29	0 0.00	0 0.00
Shoe Stores	4	25.00	0 0.00	2 0.50	2 0.40	0 0.00	0 0.00	0 0.00
1980:								
Grocery Stores	65	1.54	11 3.67	19 2.71	7 1.75	10 1.67	14 1.75	4 .22
Family Clothing Stores	5	20.00	0 0.00	1 0.14	2 .50	2 0.33	0 0.00	0 0.00
Paint & Wallpaper Stores	4	25.00	1 0.33	1 0.14	0 0.00	0 0.00	1 0.12	1 0.06
Department Stores	3	33.33	2 0.67	0 0.00	1 0.25	0 0.00	0 0.00	0 0.00
Shoe Stores	1	100.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.12	0 0.00

*Total Number of functional units (stores) of a certain function in a particular class of central villages

**Average number of functional units (stores) of a certain function in a particular class of central villages

SOURCE: Data is selected from Tables A.4, A.5 and A.6

stores was increased. The appearance of grocery stores in all classes of villages in 1950, 1970 and 1980 implies their permanent survival in all classes (Tables 4.6, 4.7 and 4.8). Paint and wallpaper stores also required an increased threshold population over time among the central villages and were reduced in number in both the first and second period of the study (Tables 4.6, 4.7 and 4.8). This function was available in almost all of the central village classes in 1950 and remained available in lower order villages in 1970 because it required a relatively low threshold of population in 1950 and 1970. The threshold population for this function increased significantly in 1980, however, due to development of the function in the higher order central villages.

The threshold population for family clothing stores decreased from 1950 to 1970 (Table 4.6), with an almost stable situation at the township level (Table 4.7). This function existed at the third order village level in 1950 and emerged in other classes of villages, particularly in the lower order ones, by 1970 (Table 4.8). The disappearance of the family clothing function from fifth and sixth order villages by 1980 (Table 4.8) revealed the requirements of this function for the larger threshold populations available in the higher order central villages.

The department store, as a higher order (complex) function, was consistently available over time only in the

higher order central villages (Table 4.8). In fact, the fifth and sixth order villages of the study area did not offer this function between 1950 and 1980 and fourth order villages were added to that list in 1980. Therefore, the threshold population required for department stores was always high compared with other functions (Tables 4.6 and 4.7). The lower threshold population for department stores in 1970 was related to an increased number of establishments in the fourth order villages which disappeared from those villages in the second period (1970-1980) when they lost the volume of customers they required to stay in business. Consequently, the threshold population for this function increased in 1980.

Shoe stores, as another high order central function, existed in the higher order villages in 1950 and 1970 (Table 4.8). At present, due to the mileage traveled by rural residents in the study area to shop for shoes in larger central places (cities), this function has a high range marketing network in the study area (Chapter VI). However, the results of threshold population analysis for 1980 (Table 4.6) and the appearance of this function in a fifth order village (Table 4.8) revealed a lower threshold population for shoe stores in 1980. It could be argued, from the willingness of people surveyed to shop for shoes in big cities that this function is highly competitive and its recent appearance in a low order villages is temporary. Some

aspects, such as the lower costs and taxes involved in opening a store in a small village, are attractive to some business operators, but they face severe problems in attracting the number of consumers required for their survival due to the flexibility of a particular function, like shoe stores.

In summary, grocery stores have been shown to be a low order central function requiring the lowest threshold of population. Therefore, they can be considered an inflexible rural function that can still survive in the smallest villages. Family clothing stores have been upgraded to higher order villages since they require greater threshold population. Therefore, they are considered a competitive (flexible) function that can be harmed by competition with urban centers. Department stores and shoe stores are high order (flexible) functions that also require greater threshold population. All these functions (grocery, paint and wallpaper, family clothing, department stores and shoe stores) will be considered later when spatial functional range models (Chapter VI) are presented to illustrate individual preferences in shopping for these functions.

Discontinuous Models Of Population And Function Relationship (Hierarchical)

The concept of rank size rule, a component of central place theory was hypothesized in this research and was supported by examination of the continuous relationship

between population size and number of functions in all the central villages studied (Figure 4.4). Thus, it was shown that the hypothesized relationship existed between population size and number of functions in each class of villages (hierarchical structure or discontinuous model).

The hierarchical classification of central places deals with the two variables of number of functions in central places (functional range) and the total functional units (establishments) in those central places. The method of hierarchical classification of central places used here was different, for instance, from that used by some investigators who employed factor analysis (Berry, Barnun and Tennant, 1962 and Smith, 1970) and employed the functional index classification used by Davies (1967) and Marshall (1969) in their research. Because central place theory is concerned with establishing whether the size/function relationship are continuous or discontinuous (Haggett, 1977: 142), discontinuous as well as continuous models were constructed in the present study to determine the size/function relationships of each hierarchical class of central villages in the study area. Figures 4.6, 4.7 and 4.8 present the discontinuous models which show the maximum range (maximum number of different functions) of each class of central villages and the threshold population for each class. The threshold population of a certain class of villages was determined to be equal to the population size of the village

Functional Range and Threshold Population for Different Orders of Central Villages: 1950

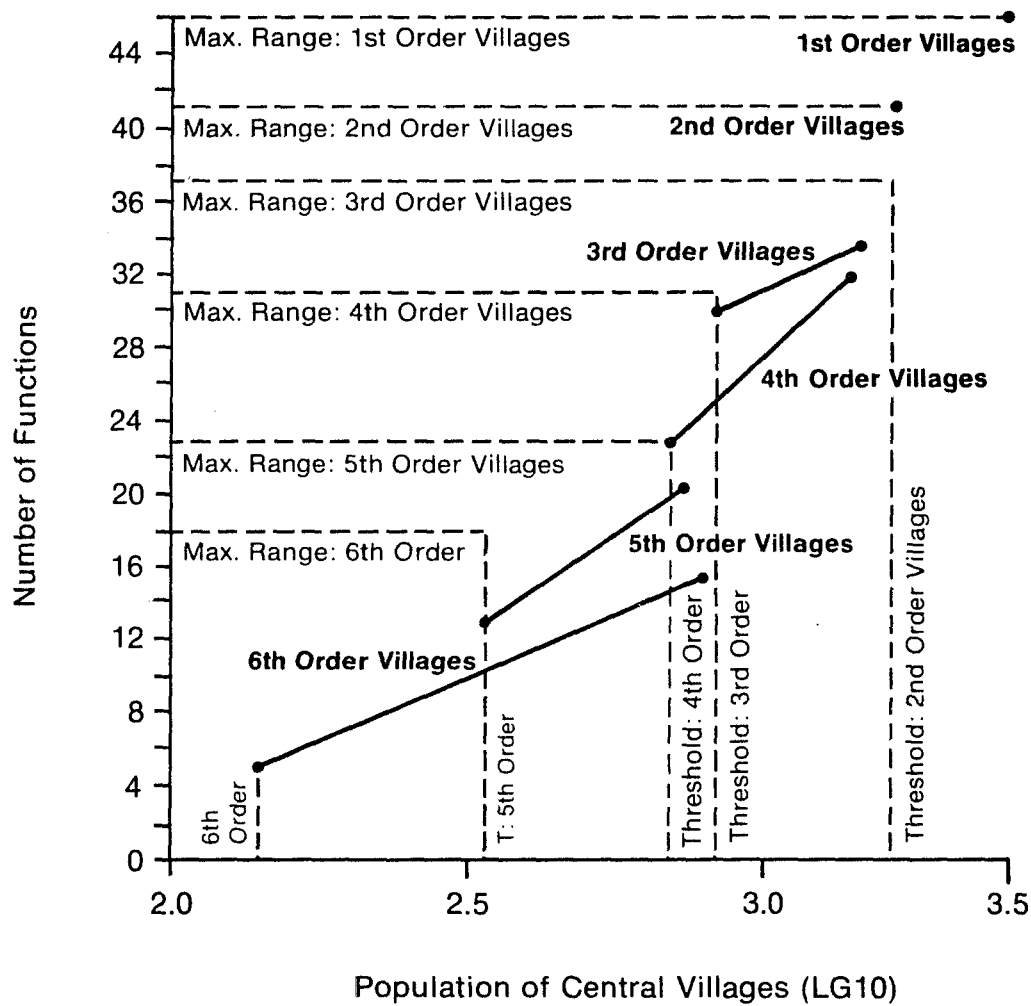


Fig. 4.6 A discontinuous model of linear relationship between number of functions and population size of each class of central villages in 1950. The maximum range of functions and threshold population (minimum size) of villages in six orders are shown.

Functional Range and Threshold Population for Different Orders of Central Villages: 1970

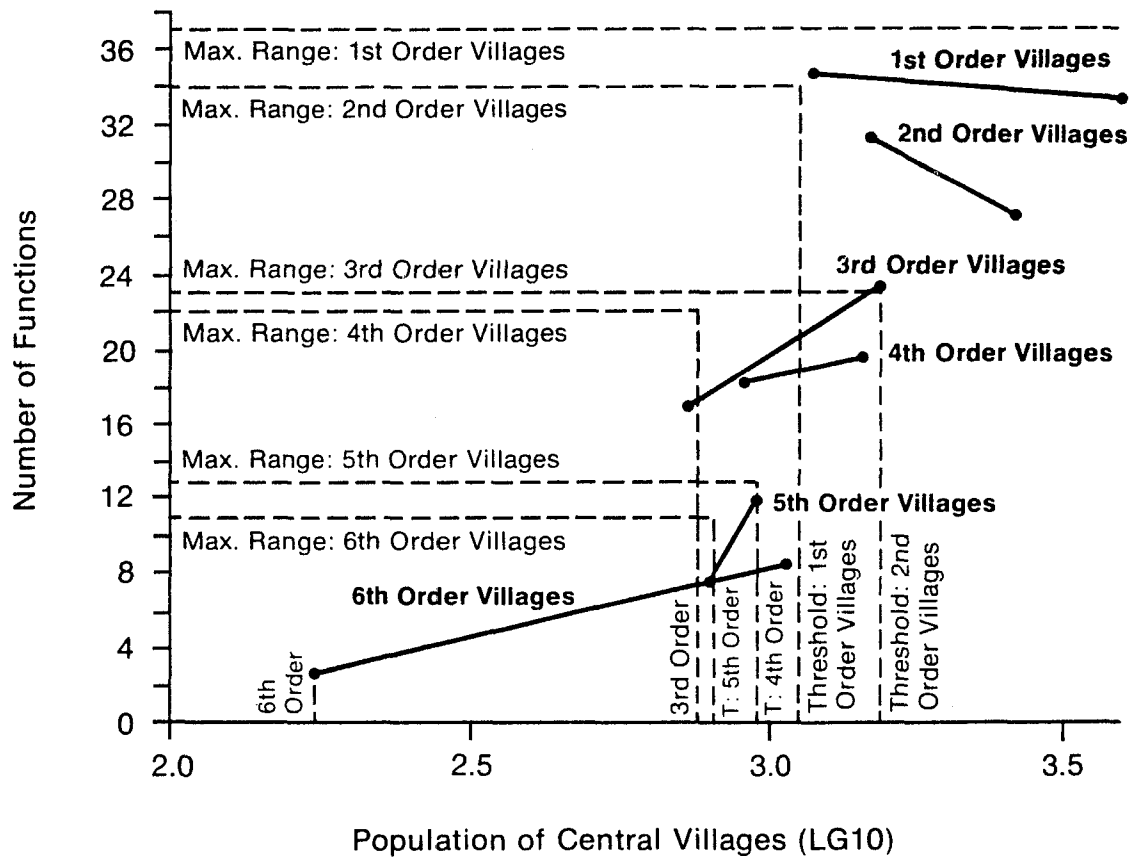


Fig. 4.7 A discontinuous model of linear relationship between number of functions and population size of each class of central villages in 1970. The maximum range of functions and threshold population (minimum size) of villages in six orders are shown.

Functional Range and Threshold Population for Different Orders of Central Villages: 1980

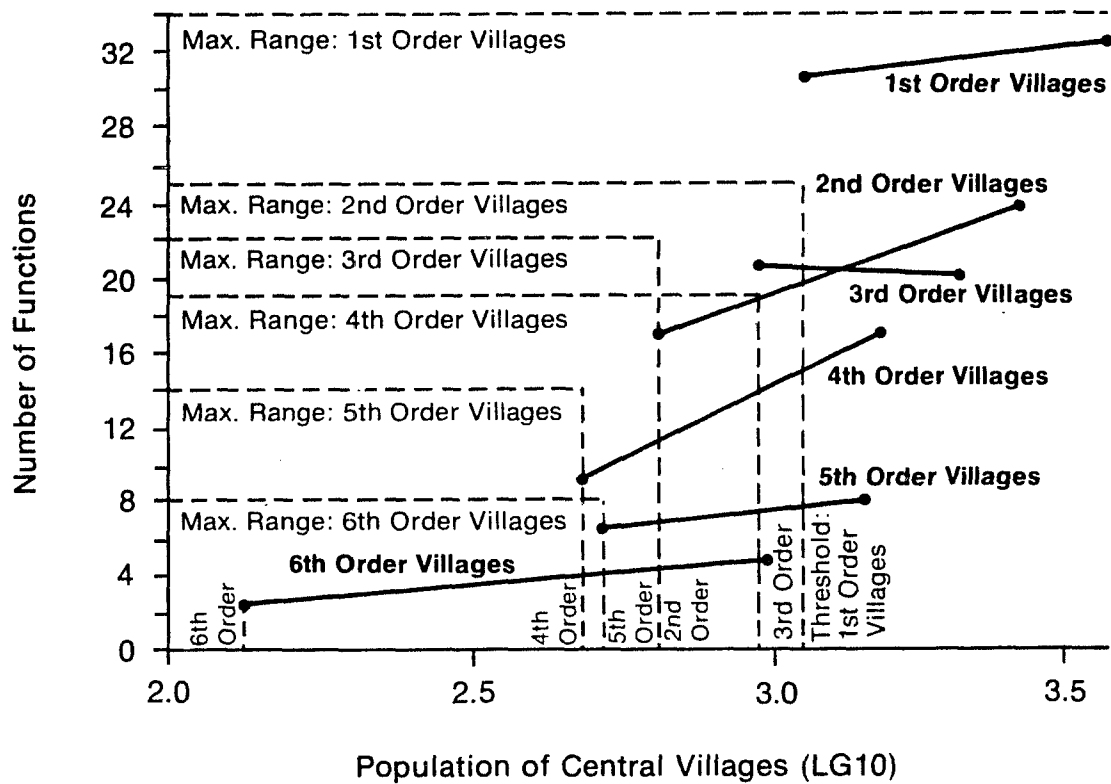


Fig. 4.8 A discontinuous model of linear relationship between number of functions and population size of each class of central villages in 1980. The maximum range of functions and threshold population (minimum size) of villages in six orders are shown.

of that particular class that had the lowest population. The regression lines are constructed on the basis of the continuous relationship of function and population size in central villages of a particular class. Each of these constructed regression lines on Figures 4.6, 4.7 and 4.8 shows the direction of the relationship between function and the size of each class of central villages. They also show the minimum (threshold) and maximum population sizes of villages of that particular class.

The reduction in the number of functions among all the classes of central villages has caused a downward relocation of maximum range of all the classes of central villages (Figures 4.6, 4.7 and 4.8). The maximum range of first and sixth order villages was 46 and 18 in 1950, which declined to 37 and 11 in 1970; and to 34 and 8 in 1980 (Figures 4.6, 4.7 and 4.8). As was shown earlier on the continuous model (Figure 4.4), the functional viability of the central villages in 1950 was greater and was significantly related to their population sizes. In 1970 and 1980, however, due to the influx of nonfarm people in central villages and surrounding townships, the increase of independent functions (residential and recreational functions such as sporting goods, boating, etc.) in some of the villages, and the general decline in the range of functions (decline in functional viability) across all classes (Figures 4.6, 4.7 and

4.8) the association between number of functions and threshold population was weakened. Therefore, a higher order class of central villages could have had a threshold population less than a lower order class. For instance, the threshold population for third order villages was less than that for fourth order villages in the study area in 1970 (Figure 4.7) and fourth order villages had lower threshold populations than fifth order villages in 1980 (Figure 4.8).

In considering the discontinuous models of relationship between the population size of villages and their functional ranges in different classes of villages, the model for 1950 was more salient than those for 1970 and 1980. Moreover, the regression coefficients show the direction of association between the population size of villages and their numbers of functions was positive in all cases in 1950; it was positive for 60 percent of the classes in 1970 and positive for 83 percent of the classes in 1980. (Table 4.9 and Figures 4.6, 4.7 and 4.8).

The negative correlation coefficients (Table 4.9) indicated that there was a negative relationship between the population size and functional range (number of functions) of a particular class of central villages. In other words, population size was not a determining factor of those villages' functional viability. The increased number of functions for residential recreational purposes may have offset the importance of population size for those villages.

TABLE 4.9: Relationship Between the Population Size of Central Villages and Their Numbers of Functions in Regard to Different Hierarchical Classes: 1950, 1970 and 1980

Central Village Class	Number of central villages in a particular class	Correlation Coefficient (Pearson's r)	Significance of r	Regression Coefficient (B Value)
1950:				
I	1	NC*	NC	NC
II	1	NC	NC	NC
III	7	.441	.16120	16.60
IV	6	.666	.07432	29.73
V	11	.688	.00963	20.80
VI	18	.608	.00404	13.75

1970:				
I	3	-.167	.44672	-1.86
II	4	-.472	.26390	-52.19
III	5	.972	.00254	15.22
IV	7	.191	.34049	4.10
V	12	.591	.2140	12.86
VI	15	.589	.01038	6.85

1980:				
I	3	.083	.47352	0.79
II	7	.759	.02380	11.48
III	4	-.172	.41400	-1.42
IV	6	.507	.15236	11.23
V	8	.329	.21341	5.75
VI	18	.232	.17695	2.33

*Not computable because there was only one observation in that particular class

The majority of central village classes had positive coefficients of correlation between population size and functional ranges (Table 4.9); therefore, the rank size rule in each hierarchical class of villages was still operating, even though the associations weakened over time.

An important projection of the change in the hierarchical structures of the central villages studied over time (See Tables A.1, A.2 and A.3) was that there was found to be an increase in the varieties of central functions and a decrease in the total functional units of those central functions in all the central villages. There were 95 varieties of function in central villages studied in 1950, which increased to 97 in 1970 and 104 in 1980, while the total functional units declined from 1301 in 1950 to 907 in 1970 and 763 in 1980 (Tables A.1 through A.6). It was noted that the distribution of varieties (types) of functions in the central places of the region was horizontal, while the distribution of functional units (stores) of a certain function across the central places of the region is a vertical distribution. For instance, the distribution of functional varieties A, B, C, D, and E in each central place 1, 2, ...10 on Table 4.1, is horizontal, while the distribution of functional units (number of stores) of function A or any other over central places 1, 2, ...10 is vertical. The increase in the varieties of central functions and decrease

in the functional units of central villages show the hierarchical structure of the central villages of the study area is shortening vertically and expanding horizontally. Central functions with location coefficients of 100 (one functional unit) were important in developing the horizontal expansion of different types of functions amongst the central villages over the study time (Tables A.1, A.2 and A.3). These central functions with a 100 location coefficient (high order functions) included 14 percent of all types of functions in 1950, 31 percent in 1970 and 28 percent in 1980. A dramatic expansion of these high order central functions was seen in the period of 1950-1970. It can be explained that due to regional development in the 1950-1970 period in the study region, several new specialized functions such as wholesale stores related to mechanized farming (farm machinery and equipment shops), advanced transportation (truck rental and leasing agency), increased residential and household demands (rug cleaning and repair services) were added to the horizontal functional structure of the central villages (Tables A.1, A.2 and A.3). The horizontal expansion of central functions from 1970 to 1980, represented the continuation of these specialized functions (location coefficients=100) and the addition of recreational-oriented functions, such as outdoor advertising services, in the study area.

In conclusion, the reduction in the total number of functional units of central functions (vertically) and the horizontal expansion of varieties of central functions (that are complex and specialized) in a spatial and temporal frame-work, verified the change in the hierarchical structures of central villages studied. It did not, however, negate the presence of strong hierarchical structure among these central villages.

CHAPTER FIVE

THE ROLE OF RURAL DEVELOPMENT IN CHANGING THE VIABILITY AND SPATIAL DISTRIBUTION OF CENTRAL VILLAGES

Change In The Number And Distribution Of Central Villages

Results of the functional classification of central villages mentioned in Chapter Four revealed six functional classes of these central villages in 1950, 1970 and 1980 (Figures 4.1, 4.2 and 4.3). The number of central villages in each class was found to vary at each of the three points in time (Table 5.1).

In order to compare the growth and decline among different classes of central villages, Tables 5.1, 5.2 and 5.3 have been prepared. Table 5.1 shows that of all the central villages the first order villages remained fewest in number and proportion at all three points in time, while the sixth order villages remained greatest in number and proportion at those points in the study area. The existence of so many sixth order villages in 1950 and 1970 and 1980 in the study area, implies that historically the least viable villages have remained a majority, which does not bode well for the

TABLE 5.1: Numbers, Proportions and Percent Change in Proportions of Central Villages Over the Study Time

	1950		1970		1950-70	1980		1970-80
	Number	Proportion	Number	Proportion	Percent Change	Number	Proportion	Percent Change
First Order Villages	1	2.2	3	6.5	4.3	3	6.5	0
Second Order Villages	1	2.2	4	8.7	6.5	7	15.2	6.5
Third Order Villages	7	15.2	5	10.9	-4.3	4	8.7	-2.2
Fourth Order Villages	6	13.0	7	15.2	2.2	6	13.0	-2.2
Fifth Order Villages	11	23.9	12	26.1	2.2	8	17.4	-8.7
Sixth Order Villages	20	43.5	15	32.6	-10.9	18	39.1	6.5

Source: Data is collected from Table 4.5

future development of central villages of this size. Over the same period, however, the number of fifth, fourth and third order villages have changed considerably in proportion to their numbers among the central villages studied. The second order villages fairly consistently represented smaller proportions of the total villages than the third, fourth, fifth and sixth order villages; they exist in greater proportions than the first order villages.

In the period from 1950 to 1970 the third and sixth order villages declined in number, while all the other classes experienced growth in their numbers (Table 5.1). It should be noted that fourth and fifth order villages saw proportionately smaller increases than first and second order villages. The overall situation implies greater viability among first and second order villages than the third, fourth, fifth and sixth order villages. The precipitous decline (-10.9 percent) in numbers of sixth order villages from 1950 to 1970 was related to sufficient growth in some of these villages to lift them to the fifth order level (Table 5.2). However, several fifth order villages declined to the sixth order level in 1970-1980 (Table 5.3). The number of sixth order villages with their poor functional viability grew over this decade, gaining 6.5 percent in contrast to their 10.5 percent decline in the previous 20 years. The increased number of sixth order villages was due

TABLE 5.2: Change in Number and Functional Hierarchical Order of Central Villages; 1950-1970

To From						
	I	II	III	IV	V	VI
I	1					
II		1				
III	2	2	1	2		
IV		1	2	3		
V			2	2	3	4
VI					9	11

Source: Tables 4.5 and A.1, A.2

TABLE 5.3: Change in Number and Functional Hierarchical Order of Central Villages; 1970-1980

To From						
	I	II	III	IV	V	VI
I	3					
II		2	2			
III		4	0		1	
IV		1	2	3	1	
V				3	2	7
VI					4	11

Source: Tables 4.5 and A.2 and A.3.

to decline in the viability of fifth order villages, not to economic progress among sixth order villages.

The period from 1970 to 1980 was favorable for the stability of first order villages and growth of second order ones. Meanwhile third, fourth and fifth order villages declined in numbers, some of them growing into the next higher of order villages and others declining to fall into the sixth order level of villages (Table 5.3). It should be mentioned that the stability and increase in number of central villages in the first and second level implies positive economic growth in their viability, while the increase in the number of sixth order villages that are economically very weak, implies more economic problems in the future. Regarding the relatively more stable economic conditions in the first and second order villages over both study periods (Table 5.1), it is expected that these highest level villages have been more viable during rural development in the study region, as will be explained later in this chapter.

Functional Viability of Different Classes of Central Villages in the Process of Change

General Perspective

The functional viability of central villages in the study region underwent change over the study periods. Central villages at the top of hierarchy, the first and second order villages, experienced growth or stability in numbers from 1950 to 1970 and 1970 to 1980 (Table 5.1) and also

showed stable patterns of spatial distribution over the study time (Table 5.20 and Figure 5). In contrast, the third, fourth, fifth and sixth order villages have not been stable in their growth or decline over the study periods (Table 5.1) and, except for the sixth order villages, they have sharply altered their spatial distribution pattern from random to dispersed or dispersed to random over the study time (Table 5.20). Generally, the growth or decline of central villages has upgraded or downgraded any particular village to one of the next two preceding or succeeding ranks or classes (Tables 5.2 and 5.3). This finding was consistent with Hodge's (1965) work on trade centers in Saskatchewan over the period of 1941 to 1961 and implied a change in the functional viability of central villages within their hierarchical structure.

There was a general decline in the range of establishments (maximum and minimum) in all classes of central villages studied over time. In a simple presentation, the average number of establishments (stores) per class of villages has declined considerably over the study time (Table 5.4), but the general decline in the establishments of these villages presents a serious economic problem that needs to be considered in greater detail. All the villages experienced some growth in their populations (Figure 3.12). The population/function relationship was maintained but was not as strong in 1970 and 1980 as it was in 1950 (Figures

TABLE 5.4: Major Characteristics of Different Classes of Central Villages Studied, for 1950, 1970 and 1980

Village Class	Number of Villages Per Class	Range of Establishments (Functional Units) Per Class	Average Number of Total Establishments Per Class	Range of Population Per Class
<u>1950</u>				
Class I	1	86-86	86	2580
Class II	1	67-67	67	1596
Class III	7	37-60	49.4	862-1466
Class IV	6	29-49	40.2	695-1410
Class V	11	16-31	23.3	339- 730
Class VI	20	5-26	15.4	145- 774
<u>1970</u>				
Class I	3	49-64	55.7	1112-3858
Class II	4	34-52	42	1617-1978
Class III	5	23-35	28	595-1650
Class IV	7	25-30	26.7	983-1558
Class V	12	5-17	11.25	473- 970
Class VI	15	3-14	7.1	175-1251
<u>1980</u>				
Class I	3	41-61	53.3	1110-3816
Class II	7	20-44	30	655-2289
Class III	4	25-30	27.5	962-2171
Class IV	6	9-22	17	490-1628
Class V	8	7-22	12.75	539-1535
Class VI	18	1-8	4.17	155-1008

Source: Tables A.1, A.2 and A.3; and U.S. Census Of Population For 1950, 1970 and 1980.

4.6, 4.7 and 4.8). The weakening importance of the population size of villages as a factor of their economic growth over the study time, may have been related to the introduction and development of industrial and recreational activities in some of these villages over the study time.

It has been noted by other researchers that American villages experienced serious losses in their retail activities and consequently in their importance as shopping centers in the period from 1950 to 1970 and the revival of village retail businesses was not consistent with their population growth in the post-1970 period (Johansen and Fuguitt, 1984:134,135). The central villages of the study area faced the same situation. Almost all of the central villages studied declined in their retail and wholesale functions over 1950-1970 and 1970-1980 (Table 5.5). Over the whole period of study (1950-1980), first order villages had lowest rate of decline and sixth order villages had the highest rate of decline (Table 5.5). It should be noted that the sixth order villages, as the lowest rank in the hierarchical structure of this study, were very vulnerable to rural development and were bypassed frequently by rural families (consumers) in favor of larger central places as a result of regional accessibility and the better selections and prices available for goods and services in urban central

TABLE 5.5: Average Number of Establishments (Total Functional Units) or Stores Per Class of Central Villages and Their Rates of Change Over the Study Periods

Village Class	Average Number of Establishments per Class 1950	Average Number of Establishments per Class 1970	Change Rate 1950-1970	Average Number of Establishments per Class 1980	Change Rate 1970-1980	Change Rate 1950-1980
First Order Villages	86	55.7	-35.23	53.3	-4.31	-38.02
Second Order Villages	67	42	-37.31	30	-28.57	-55.22
Third Order Villages	49.4	28	-43.32	27.5	-1.79	-44.33
Fourth Order Villages	40.2	26.7	-33.58	17	-36.33	-57.71
Fifth Order Villages	23.3	11.25	-51.72	12.75	+13.33	-45.28
Sixth Order Villages	15.4	7.1	-53.90	4.17	-41.27	-72.92

Source: Data is derived from Table 5.4

places (Chapter Six). Johansen and Fuguitt (1979) mention that competition with urban centers was one of the factors that caused the decline in the retail establishments and services in American villages between 1950 and 1970. The examination of farm and non-farm families' shopping travel behavior in the central villages studied confirmed the shopping preferences of the respondents for shopping in the larger central places, including the cities of southcentral Michigan (Chapter VI). The reduction in the retail and wholesale activities of central villages over the study time (Tables 5.5 and 5.8) thus resulted from competitive interaction between central villages and urban centers due to regional development and rural consumers' shopping preferences. As noted earlier, other factors such as technological advancement in the study region and agricultural industrialization in farming activities also changed the pattern of the rural population in the area and caused the elimination of some central functions (Table 5.6) or introduction and increase of other central functions (Table 5.7) throughout the central villages.

In order to investigate and analyze the changes in functional viability of different classes of central villages, their typical central functions in 1950, 1970 and 1980 will be discussed here. It should be noted that in interpreting central functions and their variations and changes in different classes of central villages the term

"typical function" is used in this research to indicate the existence of a functional unit (store) of a certain function occurring in at least a third of the central villages of a certain class, that the average number of that function is .33 or more. For instance, if there are four drugstores and one welding and repair store in first order villages (three villages), the average number of drugstores in first order villages will be: $4/3 = 1.33$ and the average number of welding and repair stores will be: $1/3 = .33$. Thus, the functions of both drugstore and welding and repair store are "typical" in first order villages. The functions with average numbers lower than .33 in a class of villages are not considered typical in this research.

General Change in the Central Functions And Rural Services of Central Villages

The hypotheses cited in Chapter Two of this research anticipated that rural development (including agricultural industrialization and transportation development in south-central Michigan) would be found to be an important factor of change in the viability of central villages over the study time. The impact of an agricultural industrialization that was instrumental in replacing the outmoded functions with new ones in the villages and small towns of the United States has been examined in empirical studies which found that most of the villages of the Middle West that

offered similar rural functions in the horse and buggy era later lost those functions with the popularization of the automobile (Hart, Salisbury and Smith, Jr., 1968). As motor transport replaced the horse and wagon, horse and wagon related businesses (such as livery and blacksmithing in the 1930s) declined and auto-related businesses (such as gasoline service stations, automobile sales and services, and auto repair garages) arose and prospered in American small towns and villages (Johansen and Fuguitt, 1973; Smith, 1970; and Stafford, 1963).

In order to investigate the situation in the central villages of the study area, Table 5.6 shows those central functions that were available in 1950 in the villages, but which had essentially disappeared by 1970. The older functions, such as shoe and harness repairing and blacksmithing, were available in the central villages in 1950 since only 55.83 percent of farms in the study region used tractors exclusively, while the rest were still using horses for farming (Table 3.1). The higher average number of wheel tractors per farm and increased percentage of farms having wheel tractors by 1970 and 1980 (Figure 3.2), clearly explains the disappearance of the outmoded shoe and harness repairing and blacksmithing functions from the central villages after 1950. The concurrent significant increase in the population of tractors and corn pickers in southcentral Michigan in the 1950 to 1970 period (Figures 3.2 and 3.3)

was influential in increasing the number of farm machinery and equipment dealers and the number of fuel oil, liquified petroleum, and gas dealers in central villages studied (Table 5.7). Indeed, the increase in farmers using motor trucks (Figure 3.4) and the 34.3 percent increase of non-farm families moving into rural southcentral Michigan from 1950 to 1970 (Table 3.3) and commuting to urban jobs favored the creation of motor vehicle dealerships to eventually replace the general machine and supply shops that were common in 1950 in the central villages studied (Table 5.7). The continuing but slower rate of change in agricultural industrialization in the study area in the 1970-1980 period (Chapter Three), had almost stabilized the growth of the above functions in central villages by 1980.

General stores, a vital and typical function of all the central villages in 1950, were represented by 39 stores (Table 5.6) that disappeared in the later decades. General stores were essential for providing household needs, including food and nonfood items, household supplies and appliances. They were a locally convenient, general function for rural residents who tended to do their shopping in the small rural places. The function of the general store was replaced by department stores in the 1950-1970 period, when the number of department stores in the central villages doubled (Table 5.7). The department stores themselves declined in the 1970-1980 period (Table 5.7), when modern

TABLE 5.6: Central Functions Offered in Central Villages in 1950 That Had Disappeared by 1970

Central Functions	Number of Functional Units (Establishments) in 1950	Proportion of Total *
General Stores	39	3.0
Foodstores & Misc.	38	2.92
General Hardware	26	2.0
Publishing & Printing	17	1.3
Shoe & Harness Repair	15	1.15
Radio (Sales & Service)	14	1.08
Men's Wear Shops	14	1.08
Food Lockers	10	.77
Fuel, Coal, Feed, Etc.	7	.54
Women's Wear Shop	6	.46
Blacksmith	5	.38

* There was a total of 1,301 functional units (establishments) in all the central villages in 1950 (Table A.4). In calculating the proportion of the total represented by each central function, those functional units were divided by 1,301 and then multiplied by 100.

SOURCE: Data is derived from Tables A.4, A.5, and A.6.

TABLE 5.7: Selected Central Functions That Increased or Emerged in the Central Villages Over the Study Time.

Central Functions	Functional Units		
	1950	1970	1980
Machine Shop & Supplies (1950); Motor Vehicle Dealers (1970, 1980)	25	31	32
Oil & Gas (distro) Co: 1950; Fuel oil dealer & petroleum & related dealer: 1970, 1980	15	23	24
Farm machinery(1950): Farm equip. dealer (1970); Farm Supplies (1980)*	10	41	21
Sporting Goods	7	10	15
Department Store *	3	6	3
Family Clothing Store	2	4	5
Boat Dealers	1	5	7
Radio & TV Repair Shop*	0	17	7
Radio & TV Store*	0	16	11
Women's Ready-to-Wear Shop	0	11	12
Liquor Store	0	7	11
Farm & Garden Machinery & Equip.	0	6	25
House Trailer dealer (1970); auto & home supply store (1980)	0	6	11
Men's & Boys' Clothing	0	5	6
Floor Covering Store	0	1	6
Industrial Supplies	0	1	5
Sewing Store	0	0	6
Mobile Home Dealer	0	0	5
Hobby, toy and game Shop	0	0	2
Outdoor Advertising Service	0	0	1

*. These central functions are selected because they have significant growth or emergence in their numbers of functional units in the first period of study time.

Source: Data is derived from Tables A.4, A.5 and A.6.

rural super markets offered more specialized goods and more convenient shopping for the rural consumers (residents). Indeed, the huge department stores of rural central places became readily accessible to those rural families (due to transportation development). Some other functions including men's wear shops and women's wear stores available in central villages in 1950, were replaced by 1970 with specialized men's and boys' clothing stores and women's ready-to-wear shops that were more applicable to the new life styles of rural residents (Tables 5.6 and 5.7).

Another impact of rural development in changing the viability of central villages was its tendency to reduce residents' dependence on or use of certain central local village functions. Bracey (1956:50) mentions that the industrialization of agriculture and the development of means of communication in concert with changes in the habits and customs of local people, have changed the central functions of small central places (towns) in England. Indeed, when the improvement of transportation technology increased the urban accessibility of American rural families they began to patronize large retail establishments of larger central places (cities) with a resulting decline in the retail sections of villages in the United States in recent decades (Johansen and Fuguitt, 1973, 1979 and 1984). Significant super highway development in southcentral Michigan (Chapter Three; Figure 3.10) and its central villages and local

network development (Figure 5.1) during the periods of 1950 to 1970, and 1970 to 1980 increased the accessibility of larger central places, such as Lansing and Jackson, for the rural families of the study area. With this increased access to cities and urban centers, a significant decline occurred in central village functions (retail and wholesale), as shown in Table 5.8, particularly in the first period of the study. This decline in functions implied the emergence of economic competition with larger central places which could afford both specialized and volume buying and could offer a better variety of goods at lower prices. The concept of economies of sale was thus influential in the new spatial distribution of central functions. All the central functions shown to be declining in Table 5.8 were also found to be declining in the works of Johansen and Fuguitt on Wisconsin villages (1973:211, 212) and other American villages (1984:118, 119) in the period of 1950-1970.

In spite of the decline and disappearance of central functions in the central villages of the study area, there have been additions to some existing functions or the introduction of new rural functions that are related to new or increased demand for particular goods and services. For example, the 10 farm machinery shops in the central villages in 1950 had increased to 41 (termed farm equipment dealers) by 1970 (Table 5.7). The significant increase in this function was related to revolutionary nature of the agricultural

TABLE 5.8: Selected Central Functions Found to Have Declined in the Central Villages Over the Study Time.

Central Functions	Functional Units		
	1950	1970	1980
Grocery Store	116	93	65
Gasoline Service Station	107	102	38
Autobody Repair Shops & Garages (1950) or General Auto. Repair shops(1970,1980)	54	13	9
Hardware Store	53	49	48
Elevator (fuel & Feed; grain & bean) and Feed Stores:1950; grain elevator & feed stores: 1970; grain elevators:1980	45	38	21
Drugstore	42	31	22
Electric sup. (sales & serv.) 1950; Electric repair shops & sup. stores:1970; Electrical & Electronic repair shop:1980	29	4	3
Variety & Gift Shops *	27	20	22
Funeral Service	26	25	9
Plumbing & Heating	25	4	1
Confectionery	21	3	2
Furniture Store	18	15	14
Auto sup. (1950); auto equip. & parts & battery,tire and accessory dealers (1970,1980)	17	16	11
Jewelry Store	17	9	7
Meat or meat & fish market	12	6	3
Welding & Repair	12	3	1
Dry cleaning & laundry	11	6	1
Dairy product store	10	7	1
Paint,glass and wallpaper store*	9	2	4

*. These functions are selected because they experienced great decline in the first period of the study.

SOURCE: Data is derived from Tables A.4, A.5 and A.6

mechanization and industrialization that took place from 1950 to 1970 in the study region (Chapter Three). The development and application of new farm machinery, equipment and supplies of increasing sophistication accelerated the development of mechanized, specialized and incorporated farming and provided the impetus and opportunity for increasing the farm equipment dealerships in the central villages of the study area in 1970. The emergence of six farm and garden machinery and equipment stores in 1970 and their increase to 25 in 1980 (Table 5.7) reflected the new demands of farm and nonfarm families for hobby or small gardening tools and supplies. The concurrent decrease in the number of farm equipment dealers from 41 in 1970 to 21 in 1980 reflected the trend to fewer and larger farms and the influx of part-time or hobby farmers whose needs swelled the number of farm and garden machinery and equipment dealers from 6 in 1970 to 25 in 1980 (Table 5.7) in the central villages.

The increase of sporting goods stores and boat dealers over the three points of the study time (Table 5.7) indicated the increasing demand for leisure time and recreational activities that developed in the central villages, particularly from 1970 to 1980, due to increase in the rural nonfarm population and the development of recreational functions in the central villages. The emergence of mobile home dealers; hobby, toy and game shops; and outdoor advertising

services in the central villages (1970-1980) was likewise related to the increasing residential functions of the central villages and their hinterlands and the increasing importance of leisure time pursuits and recreational activities in the study region in recent years.

Overall, the declining functions and their respective establishments across the central villages studied exceeded the new or increasing central functions over the study period. According to Tables A.4, A.5 and A.6, the total number of retail and wholesale establishments in the central villages was 1,301 in 1950 which declined to 907 in 1970 (-30.28 percent) and to 763 in 1980 (-15.88 percent). The greater reduction in central village function took place in the first period of the study which was most closely associated with revolutionary rural development in the study region.

Change in social or public functions in the central villages came about differently. Public and social functions, including religious and social facilities rank second among general functions in American small towns (Stafford, 1963:168). These public or professional functions in the central villages studied, for which data were available, are shown in Table 5.9 for 1970 and 1980. Most of these were found to have little importance in the functional viability of central villages due to their low Location Coefficients. For instance, church, school, doctor's office, bank, dentist, veterinarian, attorney, and barbershop ranked among the

Table 5.9: Functional Units of Rural Services, Including Professions, in Central Villages: 1970-1980

Rural Services Including Professions	<u>Functional Units</u>	
	1970	1980
School	97	69
Church	89	195
Bank	36	47
Doctor's Office	28	64
Barbershop	22	27
Dentist	21	36
Attorney	15	32
Veterinarian	11	32
Optometrist	2	9
Clinic	1	8
Hospital	1	1

Source: Data is derived from Tables A.7 and A.8

lowest order functions in the location coefficient classification (Table 2.3). Optometrists and clinics fell into the second and third rank of ten classes of functions according to their location coefficients; and only hospitals were exceptional for their higher location coefficient (Table 2.3). Therefore, the increase in these public and professional functions (except schools and hospitals) over the period from 1970 to 1980 was not as significant as that of retail and wholesale functions in changing the economic viability of the central villages. This does not lessen their importance, however, because their social and cultural influence cannot be ignored. The increase of these public functions was closely related to the increase of population that resulted from rural development in the study region (Chapter Three). Among these functions, schools declined (-28.9 percent) in response to regional development and a policy of school consolidation in the central villages, according to information derived from public questionnaires. It should be noted that consistent with school consolidation techniques, first order villages gained schools, while all other classes of villages lost schools. Thus, a principle of economies of scale (concentrating functions) was applied in the region for its economic advantages. In fact, establishing a large school, which is viable economically, is preferred to having several uneconomical, small and

dispersed schools in regional planning for a certain region (Cloke, 1979).

Functional Changes of First Order Villages

First order villages, as the strongest class in the functional viability classification, had the lowest rate of decline in the average number of their total establishments from 1950-1980 compared with other classes (Table 5.5). The greatest rate of decline in retail and wholesale activities is seen in the first period of study, when it is almost a general trend for all of the central villages studied (Table 5.5). The technological changes in the study area from 1950 to 1970 encouraged the elimination of functions listed on Table 5.11, including general stores, food stores, and miscellaneous (grocery), shoe and harness repair and radio shops and services from the first order villages. Publishing and printing disappeared from the first order villages probably due to the failure of local newspapers in competition with those of larger towns and cities that offered more news and advertising for larger stores in larger central places. The decline in other typical functions in first order villages during the first period of study including grocery stores, gas stations and drug stores was a general trend for all of the central villages (Tables 5.8 and 5.10). But in all cases, the first order villages had

more total establishments representing these three functions.

The decline of these three functions in 1950-1970 was related to the decreasing demands for them by local people who traveled further and did their multipurpose shopping in the chain department stores such as Meijers and K-Marts in nearby cities that offered cheaper goods and were equipped with nearby gasoline service stations. These three central functions declined in all of the central villages in both periods of study (Table 5.10). But, there was only an increase in the number of drugstores in first order villages in 1970-1980. This increase of drugstores in the first order villages was related to their significant decrease in the other classes of villages. Drugstores were a typical function in all classes of central functions in 1950, were typical in all of them except sixth order villages in 1970, but became typical only for first, second, third and fourth order villages in 1980 (Table 5.10). The decline in typical central functions of electrical supplies and repair shops, meat and fish markets, dry cleaning services and dairy product stores in the first order villages (Table 5.13) was related to the decline and disappearance of these functions from all of the classes of villages and was continued in the second period of the study (Table 5.10).

The decline and disappearance of these functions was related to the principle of economies of scale, meaning that

TABLE 5.10: Selected Central Functions That Declined in the Central Villages by Average Value Per Class for 1950, 1970 and 1980

Central Functions	First Order Villages	Second Order Villages	Third Order Villages	Fourth Order Villages	Fifth Order Villages	Sixth Order Villages
Grocery Store:						
1950	9.00	4.00	3.00	3.40	4.20	1.75
1970	5.00	3.25	2.80	2.43	1.33	1.20
1980	3.67	2.71	1.75	1.67	1.75	.22
Gasoline Service Sta.						
1950	8.00	6.00	6.10	5.30	3.10	2.70
1970	5.33	3.00	3.20	3.43	1.42	1.13
1980	2.67	1.71	.75	.67	.75	.28
Auto Body Repair Shops or General Auto Repair Shop:						
1950	3.00	2.00	1.57	1.17	.73	1.15
1970	.33	.50	.40	.43	.08	.27
1980	1.00	.14	.25	.17	0.00	.17
Hardware Store:						
1950	2.00	2.00	1.60	1.50	.80	1.00
1970	1.70	2.25	1.20	1.29	1.08	.47
1980	1.33	1.86	1.50	1.33	.62	.67
Grain Elevator & Feed Store:						
1950	1.00	1.00	1.58	1.01	.81	.85
1970	1.33	2.00	.80	1.15	.66	.40
1980	.33	.57	1.00	.83	.50	.17
Drugstores:						
1950	3.00	2.00	1.57	1.34	.91	.40
1970	1.70	1.50	1.00	1.00	.42	.20
1980	2.67	1.00	.50	.50	.20	0.00
Electrical Supplies & Repair Shops:						
1950	1.00	3.00	.57	1.17	.73	.30
1970	.33	.25	.20	.14	0.00	0.00
1980	.33	.25	0.00	0.00	0.00	0.00
Funeral Services:						
1950	1.00	0.00	.86	.67	.64	.40
1970	1.70	.25	.80	1.00	.33	.80
1980	.67	.29	.50	0.00	.12	.11
Plumbing & Heating:						
1950	0.00	0.00	1.43	1.17	.36	.20
1970	.67	0.00	0.00	.14	.08	0.00
1980	0.00	.14	0.00	0.00	0.00	0.00
Confectionery:						
1950	1.00	3.00	1.00	.67	.09	.25
1970	0.00	.25	0.00	.14	.08	0.00
1980	0.00	.29	0.00	0.00	0.00	0.00
Furniture Store:						
1950	0.00	1.00	.86	.34	.36	.25
1970	.67	.75	.20	.86	.25	0.00
1980	1.67	.43	.50	.50	.12	0.00
Auto Supp. & Equip:						
1950	2.00	3.00	.57	.34	.36	.10
1970	1.67	1.50	0.00	.14	.16	.14
1980	1.33	.14	.75	.17	.12	.06
Jewelry Store:						
1950	2.00	2.00	1.14	0.00	.27	.05
1970	1.00	.50	.40	.14	0.00	.07
1980	1.33	.29	.25	.17	0.00	0.00
Meat & Fish:						
1950	1.00	0.00	.86	.17	.18	.10
1970	.33	.50	.20	0.00	.17	0.00
1980	0.00	.14	0.00	.17	.12	0.00
Welding & Repair:						
1950	0.00	0.00	.71	.17	.27	.15
1970	.33	0.00	.20	0.00	0.00	.07
1980	0.00	.14	0.00	0.00	0.00	0.00
Dry Cleaning:						
1950	1.00	2.00	.57	.34	.09	.05
1970	.67	.50	0.00	.29	0.00	0.00
1980	0.00	0.00	.25	0.00	0.00	0.00
Dairy Production:						
1950	1.00	2.00	.29	.50	.09	.05
1970	.33	.25	.60	.29	0.00	0.00
1980	0.00	.14	0.00	0.00	0.00	0.00

SOURCE: Data is derived from Tables A.4, A.5 and A.6 and 5.5

TABLE 5.11: Selected Central Functions That Essentially Disappeared From the Central Villages After 1950, by Average Number of Total Establishments per Class of Central Villages for 1950

Central Functions	Average Number of Total Establishments					
	First Order Villages	Second Order Villages	Third Order Villages	Fourth Order Villages	Fifth Order Villages	Sixth Order Villages
General Store	1.00	0.00	.71	1.17	1.18	.65
Food Stores & Misc.	2.00	1.00	1.43	1.17	.82	.45
General Hardware	2.00	1.00	.57	.83	.64	.35
Publishing & Print.	1.00	1.00	.86	.67	.18	.15
Shoes & Harness Repair	1.00	0.00	.57	.67	.27	.15
Radio Shops (Sales & Service)	1.00	0.00	.57	.67	.27	.10
Men's Wear Stores	2.00	2.00	.71	.34	0.00	.15
Food Lockers	0.00	1.00	.29	.50	.18	.10
Fuel, Oil, Feed, etc.	0.00	1.00	.71	0.00	0.00	.05
Women's Wear Stores	0.00	2.00	.29	.17	0.00	.05
Blacksmithing	0.00	0.00	.43	0.00	.09	.05

SOURCE: Data is collected from Tables A.4, A.5 and A.6

these functions lost their viability in central villages and were consolidated in larger cities. Grain elevators and feed stores that declined generally in the central villages studied over the study time (Table 5.8) were typical central functions in all of the classes of central villages in 1950 and 1970 (Table 5.10). They declined dramatically in all of the central villages during the second period of study (Tables 5.8 and 5.10) and became typical for first, second, third, fourth and fifth order villages in 1980. The decline in these local elevators, particularly in the period of 1970-1980, was related to the development of fewer but more efficient industrialized and specialized grain elevators in central villages and urban central places. Indeed, the significant increase in average farm income was due to farm industrialization in 1970-1980 (Figure 3.8) and wealthier farmers preferred to deal with larger scale and more efficient and economical elevators that were responsive to the advanced industrialized farming in the study area. In the public questionnaires of this research it was revealed that about thirty-five percent of farmers in central villages' hinterlands bypassed their local towns to visit the larger elevators in other central places.

Farm machinery and farm-and-garden equipment (47 stores) had more than quadrupled in the central villages by 1970 compared with the 10 farm machinery and equipment stores in 1950 (Table 5.7). This function thrived due to

agricultural industrialization in the hinterlands of central villages that required more sophisticated agricultural equipment responsive to the revolutionary progress in mechanization in the study area from 1950 to 1970 (Chapter Three). This function was typical for first, second, third, and fourth order villages in 1950 and became almost typical of all the villages by 1970 and 1980 (Table 5.12). This means that this particular function is a viable central function that has existed at all the levels of central villages over the time of the study. This function is particularly strong in first order villages.

The introduction and popular use of television by rural residents of the study area in the early 1960s meant the radio stores and repairs in 1950 were replaced by radio and TV stores and repairs at the end of the first period of study in first, second, third and fourth order villages (Tables 5.12 and 5.13). It was still a typical function of these four classes of central villages in the 1970-1980 period. The adoption of TV by rural farm and nonfarm families in the study area was a result of technological advancement and change in the lifestyles of these families over the study period. Any such adoption of a technological advancement will be influenced in changing the viability of central villages.

The increase of rural population in both periods of study in the region and in the townships surrounding the

TABLE 5.12: Selected Central Functions That Either Emerged or Increased in the Central Villages, by Average Value Per Class of Central Villages for 1950, 1970 and 1980.

Central Functions	First Order Villages	Second Order Villages	Third Order Villages	Fourth Order Villages	Fifth Order Villages	Sixth Order Villages
Machine Shops or Motor Vehicle Dealers:						
1950	5.00	1.00	.29	1.00	.55	.25
1970	3.03	1.75	1.00	1.28	0.00	.07
1980	2.67	1.43	1.75	.34	.62	.06
Oil & Gas & Petroleum:						
1950	1.00	1.00	.43	.50	.36	.15
1970	.67	2.25	.40	.42	.33	.20
1980	1.00	1.01	.75	.34	.25	.12
Farm Equip. & Farm & Garden Machinery & Equip:						
1950	2.00	1.00	.29	.34	.09	.10
1970	1.33	3.25	.60	1.72	.25	.80
1980	1.66	1.14	2.25	1.13	.87	.50
Sporting Goods:						
1950	0.00	1.00	.43	.34	0.00	.05
1970	.33	.50	.60	.43	.08	0.00
1980	1.33	.71	.50	.17	0.00	.17
Family Clothing Stores:						
1950	0.00	0.00	.29	0.00	0.00	0.00
1970	0.00	.25	0.00	.14	.08	.07
1980	0.00	.14	.50	.33	0.00	0.00
Boat Dealers:						
1950	0.00	0.00	0.00	.17	0.00	0.00
1970	.33	0.00	.40	.14	.08	0.00
1980	.67	.29	.25	.17	.12	0.00
Radio & TV Store & Repair:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	2.00	1.00	1.80	.43	.25	.07
1980	.67	1.14	1.25	.46	.17	.12
Women's Ready-to-Wear Shops:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	.67	.50	.80	.29	0.00	.07
1980	1.30	.71	.50	.17	0.00	0.00
Liquor Stores:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	.67	.50	0.00	.14	.17	0.00
1980	1.33	.29	1.00	0.00	.12	0.00
House Trailer Dealers:						
1950	0.00	.25	0.00	0.00	0.00	0.00
1970	.33	.25	.40	.14	.08	0.00
1980	.67	.43	.75	.17	.25	0.00
Men's & Boy's Clothing Store:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	.67	.50	.20	0.00	0.00	0.00
1980	.67	.43	.25	0.00	0.00	0.00
Floor Covering Store:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	.20	0.00	0.00	0.00
1980	.67	.43	0.00	0.00	.12	0.00
Industrial Supp:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	.33	0.00	0.00	0.00	0.00	0.00
1980	1.00	.14	.25	0.00	0.00	0.00
Sewing Store:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1980	.33	.29	0.00	0.00	.37	0.00
Mobile Home Dealer:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	.14	0.00	.33	.25	0.00
Hobby Shop:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	.29	0.00	0.00	0.00	0.00
Outdoor Advertising Service:						
1950	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1980	.33	0.00	0.00	0.00	0.00	0.00

SOURCE: Data is collected from Tables A.4, A.5 and A.6.

TABLE 5.13: Typical Central Functions Offered in First
Order Villages: 1950, 1970 and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery Store	9.00	5.00	3.67
Gasoline Service Station (Filling & Service Station)	8.00	5.33	2.67
Hardware Store	2.00	1.70	1.33
Eating Place (Restaurant)	5.00	3.00	3.00
Drugstore	3.00	1.70	2.67
General Store	2.00	0.00	0.00
Food Stores and Misc.	2.00	0.00	0.00
Drinking Places (Taverns & Bars)	2.00	2.33	1.33
Implements (Agricultural)	3.00	0.00	0.00
Electrical Supply Stores (Sales & Service)	1.00	.33	.33
Variety & Gift Shops	1.00	1.67	2.67
Auto Body repair Shops & Garages (1950) or general automobile repair shops (1970,1980)	3.00	.33	1.00
Funeral Services	1.00	1.70	.67
General Merchandise Store	0.00	.67	.33
General Hardware Store	2.00	0.00	0.00
Machine Shops & Supp. (1950)			
Motor Vehicle Dealers (1970 1980)	5.00	3.03	2.67
Confectionery & Misc.	1.00	0.00	0.00
Jewelry Store	2.00	1.00	1.33
Publishing & Printing	1.00	0.00	0.00
Auto Supplies (1950); auto- mobile equip. parts, battery, tire and accessory dealers (1970,1980)	2.00	1.67	1.33
Shoes & Harness repair	1.00	0.00	0.00
Oil & gas or petroleum and related	1.00	.67	1.00
Radio (Sales, Service)	1.00	0.00	0.00
Men's Wear	2.00	0.00	0.00
Lunchrooms	1.00	0.00	0.00
Meat or Meat & Fish market	1.00	.33	0.00
Dry Cleaning & Laundry	1.00	.67	0.00
Dairy Product Store	1.00	.33	0.00
Farm Machinery (Supplies) or equip. dealers	2.00	1.33	.33
Grain Elevator & Feed Store	1.00	1.33	.33
Florist (Greenhouse)	2.00	.67	1.33
Paint, Glass & Wallpaper Store	1.00	0.00	.33
Flour Milling	1.00	0.00	0.00
Billiards	1.00	0.00	0.00

TABLE 5.13: Cont.

Central Functions	Average Number		
	1950	1970	1980
Department Store	1.00	1.00	.67
Shoe Stores	1.00	0.00	0.00
Photo or Photofinishing Labs	1.00	.33	0.00
Car Washes	1.00	.33	.33
Household Appliance Stores	1.00	.33	.33
Farm and Garden Machinery & Equipment	0.00	0.00	1.33
Lumber & Building Material Dealers	0.00	1.00	1.33
Radio & TV Stores & Repair Shops	0.00	2.00	.67
Furniture Store	0.00	.67	1.67
Women's Ready-to-Wear Stores	0.00	.67	1.33
Sporting Goods & Services	0.00	.33	1.33
Bowling Alleys	0.00	1.00	.67
Lumber & Construction Materials	0.00	.33	.33
Liquor Stores	0.00	.67	1.33
House Trailer Dealers (Auto & Home Supp. Store)	0.00	.33	.67
Boat Dealers	0.00	.33	.67
Fuel & Ice Dealers	0.00	.33	0.00
Men's & Boys' Clothing Stores	0.00	.67	.67
Retail Bakeries	0.00	.33	.33
Plumbing and Heating	0.00	.67	0.00
Used Car Dealers	0.00	.33	0.00
Paper & Paper Pds.	0.00	.33	0.00
Welding Repair	0.00	.33	0.00
Used Merchandise or Second Hand Store	0.00	.33	.33
Automatic machinery	0.00	.33	0.00
Drapery, Curtain & Upholstry Stores	0.00	.33	.33
Fresh Fruits & Veggies.	0.00	.33	0.00
Industrial Supplies	0.00	0.00	1.00
General Auto. Shops	0.00	0.00	1.00
Retail Nurseries	0.00	0.00	.67
Floor Covering Store	0.00	0.00	.67
Sewing Stores	0.00	0.00	.33
Cigar Stores	0.00	0.00	1.33
Misc. Home Furnishing Stores	0.00	0.00	.33
Data Processing Service	0.00	0.00	1.00
Motorcycle Dealers	0.00	0.00	.33
Farm Product Raw Materials	0.00	0.00	.33
Metal Service Centres	0.00	0.00	.33
Outdoor Advertising Services	0.00	0.00	.33
Family & Commercial Laundries	0.00	0.00	.33
Service Establishment Equip & Supplies	0.00	0.00	.33

SOURCE: Tables A.4, A.5 and A.6.

central villages studied (Figure 3.12) and the increase of recreational activities in this area favored some central functions such as sporting goods, boat dealers and household trailer dealers over the study time (Table 5.12). Sporting goods became a typical function for first order villages in 1970 and had increased by 1980. Boat dealers and house trailers were non-typical functions introduced to central villages in the 1950s, but had become typical in some of the classes of villages, including first order villages by 1970 and 1980 (Table 5.12).

The emergence of some new typical central functions such as data processing services, motorcycle dealers, and outdoor advertising services in first order central villages in 1980 (Table 5.13) implied the development of first order villages in business and recreation-oriented activities in 1980.

At the present time, first order villages serve industrial, agricultural, recreational, social and residential functions. The significant increase in the industrial function of first order villages began in the 1960s. Some of these industries, such as the Dexter Mill, provide feed and grain for animals and serve the farming population. The increase of the non-farm population and hobby or part-time farming in the hinterlands of these villages increased the garden supplies and pet supplies functions in first order villages. Grain elevators, agricultural shops and fairs

(tractors, implements, tools, farm appliances) and other farming needs, including gloves and boots for farmers, vet supplies and feed for farm animals are central agricultural functions serving today's farming needs in first order villages. These first order villages are visited by about 70 percent of the farmers for elevator and feed supplies and are bypassed by other farmers for grain elevators in larger central places. Detailed patterns of farm and non-farm families' shopping for certain sampled central functions in the central villages studied are discussed in Chapter Six. Such patterns show the patronization or dispatronization of central villages for different functions.

The increase of rural non-farm population due to regional development in the farm landscape and consequently in the townships surrounding the first order village, was supportive for development of rural services that are primarily socially oriented functions. Schools, churches, banks, doctors, barbershops, dentists, attorneys, veterinarians, optometrists, clinics and hospitals grew considerably in first order villages in the 1970-1980 period (Table 5.19). Due to school consolidation, second, third, fourth, fifth, and sixth order villages witnessed declines in their average number of schools (Table 5.19). Thus, only first order villages may be considered viable for schools' economies of scale policy. The increase of rural non-farm population also enhanced the residential function of central villages

and caused housing and apartment development around first order villages' limits.

In conclusion, first order villages have had smaller losses in their retail sections compared with other classes of central villages over the study period. Their growth in industries (manufacturing) has provided employment opportunities that are positive signs for future development. Their agricultural functions have declined but they have become more efficient and more agri-business oriented. The growth in their recreational activities has been supported by newcomers and rural non-farm families and has been helpful for the growth of some retail functions such as boat dealers in the first order villages. The first order villages' residential function will continue to develop due to future increases in non-farm population. It is anticipated according to the public questionnaires, that these first order villages will grow as rural towns in the future.

Functional Changes of Second Order Villages

Second order villages increased their numbers in both periods of study (Table 5.4) and thus may be considered the second most viable group among the classes of villages studied. The decline in their retail and wholesale stores (functional units) in both periods of study (particularly the greater decline in the first period) was a phenomenon that was consistent for almost all of the central villages

in the study periods (Table 5.5). The disappearance of central functions available in 1950, such as food stores and miscellaneous, food lockers, and fuel, coal and feed retailers from second order central villages in 1970 was related to these functions becoming outmoded, whereas they had been required in 1950 by the rural residents in townships surrounding the second order villages (Tables 5.11 and 5.14). For instance, the groceries and food items became available at lower prices in greater variety in super markets or corporate food stores and food lockers were outmoded as new sophisticated refrigerators and freezers became available in department stores and chain stores situated in large towns and cities. Finally, fuel, coal and feed stores were outmoded by 1970, when oil and gas and petroleum dealers had emerged in second order villages (Table 5.12). The reason for these changes may be found in the technological advancements and highways and super highway development in southcentral Michigan. The disappearance of general hardware and publishing and printing functions from second order villages in the 1950-1970 period was related to the operation of economies of scale for these types of central functions that were then concentrated in bigger, urban central places, when increases in regional accessibility hurt the small retail stores in the villages. This reason also explains the second order villages' declining central

TABLE 5.14: Typical Central Functions Available in Second Order Villages: 1950, 1970 and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery store	4.00	3.25	2.71
Gasoline Service Station (Filling & Service Sta.)	6.00	3.00	1.71
Hardware Store	2.00	2.25	1.86
Eating Place (Restaurant)	2.00	.75	1.29
Drugstore	2.00	1.50	1.00
Food Stores and Misc.	1.00	0.00	.29
Automobiles & Tractors	2.00	0.00	0.00
Drinking Places (Taverns/Bars)	3.00	1.50	.86
Electric Supply Stores (Sales/Services)	3.00	.25	0.00
Auto body repair shops & Garages (1950) or general automobile repair shops (1970, 1980)	2.00	.50	.14
Variety & Gift Shops	1.00	.50	.86
General Hardware	1.00	0.00	0.00
Machine Shops & Supplies (1950); motor vehicle dealers (1970, 1980)	1.00	1.75	1.43
Confectionery & Misc.	3.00	.25	.29
Grain Elevators & Feed Store	1.00	2.00	.57
Furniture Store	1.00	.75	.43
Jewelry Store	2.00	.50	.29
Publishing & Printing	1.00	0.00	0.00
Auto Supplies (1950); automobile equip. & parts and battery, tire and accessory dealers (1970, 1980)	3.00	1.50	.14
Oil & gas or petroleum & related	1.00	2.25	1.01
Men's wear	2.00	0.00	0.00
Dry Cleaning & Laundry	2.00	.50	0.00
Dairy Product Store	2.00	.25	0.00
Farm Machinery (Equip. & Sup)	1.00	2.50	.57
Food lockers	1.00	0.00	0.00
Florist (greenhouse)	1.00	.50	.43
Fuel, Coal, Feed, etc.	1.00	0.00	0.00
Sporting Goods	1.00	.50	.71
Women's Wear Shop	2.00	0.00	0.00
Auto-farm Implement	1.00	0.00	0.00
Books and Newspapers	1.00	0.00	0.00
Fruits	1.00	0.00	0.00
Department Store	1.00	.25	0.00
Shoe Store	1.00	.50	0.00
Tractors	1.00	0.00	0.00

TABLE 5.14: Cont.

Central Functions	Average Number		
	1950	1970	1980
Yarn	1.00	0.00	0.00
Lumber and Building Material Dealer	0.00	1.50	1.14
Funeral Service	0.00	.25	.29
General Merchandise Store	0.00	.75	.57
Radio & TV Store and Repair Shop	0.00	1.00	1.14
Women's Ready-to-Wear Store	0.00	.50	.71
Bowling Alleys	0.00	.50	0.00
Liquor Store	0.00	.50	.29
Farm & Garden Machinery & Equip.	0.00	.75	.57
Meat or Meat and Fish Market	0.00	.50	0.00
Fuel and ice dealer	0.00	.50	0.00
Men's & Boys ' Clothing	0.00	.50	.43
Paper & Paper Products	0.00	.50	0.00
Poultry & Poultry Products	0.00	.50	.29
House Trailer Dealer (Auto & home Supp. stores)	0.00	.25	.43
Boat Dealers	0.00	0.00	.29
Construction Materials	0.00	0.00	.43
Floor Covering Store	0.00	0.00	.43
Sewing Store	0.00	0.00	.29
Upholstry & furniture Repair	0.00	0.00	.29
Hobby, Toy and Game Shops	0.00	0.00	.29

SOURCE: Tables A.4, A.5 and A.6.

functions of auto repair shops, auto supplies and equipment stores, and jewelry stores (Table 5.10).

Increasing central functions such as machine shops or motor vehicle dealers, oil and gas and petroleum dealers and farm and garden related machinery rose dramatically in the 1950-1970 period in the central villages studied, but saw light growth in the second period of study (Table 5.7), particularly in second order villages (Table 5.12). Due to revolutionary rural development in the study area in the first period of study, agricultural mechanization required new farm equipment stores and was associated with an increase of non-farm population who participated in farm gardening in the study area and second order villages. Indeed, the increase of nonfarm families in rural areas favored the increase of motor vehicle dealers in second order villages. Therefore, increased farm machinery on the farms and increased private cars belonging to rural nonfarm families, were influential in increasing the oil and gas and petroleum dealerships in second order villages from 1950 to 1970. The decline of these three functions in second order villages from 1970 to 1980 (Table 5.12) was due to the almost stable condition of their total functional units throughout all the central villages from 1970 to 1980 (Table 5.7).

House trailer dealers, floor covering stores, and hobby shops emerged and developed as prosperous central functions in second order villages over the study time (Table 5.12).

They resulted from the increase of rural nonfarm population and increased leisure time pursuits among farm and nonfarm families.

Second order villages increased in agricultural, recreational, residential and industrial functions that serve rural residents or rural visitors (recreational visitors). These villages tended to make available such functions as supermarkets; mills; animal medicine; some machine parts in belts, building and plumbing supplies; auto dealers, and modern elevators with new fertilizer services. About 57 percent of farmers visited these villages for their elevator, mill, fertilizer, and animal feed and medicine needs. Their industrial (manufacturing) functions were much less than the first order villages, but they still offered some employment opportunities for rural residents. They experienced some growth in industries in the 1970s. The housing development that started in the middle of the 1970s involved an increase of rural nonfarm population in the second order villages and their surrounding farm-landscapes. Recreational activities including parks and boating in these villages attracted visitors, particularly during the summer and were influential in supporting some retail stores in second order villages. Rural services responsive to the needs of rural residents of second order villages, except schools, emerged or increased in the 1970s in those villages (Table 5.19). Speculation about the future of second order

villages includes growth in residential and manufacturing functions and declining or stabilizing retail functions. Public questionnaires administered in this study revealed that knowledgeable local people believe there will be stable economic conditions in second order villages in the future.

Functional Change of Third Order Villages

Third order central villages declined in numbers during both periods of study (Table 5.1). This continuous decline in the viability of third order villages was associated with numerous declines in their central functions, particularly those functions which were typical among these third order villages in 1950, but had disappeared by 1970 (Table 5.11). All of the function in Table 5.11 existed in third order villages in the 1950s but declined and disappeared by 1970, indicating that the impact of rural development has greatly damaged third order villages. The disappearance of general stores and food stores and miscellaneous shifted the pattern of shopping from these villages to supermarkets and department stores in larger central places. The need for local department stores in third order villages, caused the appearance of local department store retailers in these villages by 1980 (Table 5.15). Other functions including shoe and harness repairing and blacksmithing (outmoded by agricultural industrialization in the study area); general hardware and publishing and printing (lost to competition

TABLE 5.15: Typical Central Functions Available in Third Order Villages: 1950, 1970 and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery Store	3.00	2.80	1.75
Gasoline Service Station (Filling & Service Station)	6.10	3.20	.75
Hardware Store	1.60	1.20	1.50
Eating Places (Restaurant)	1.70	1.40	1.00
Drugstore	1.57	1.00	.50
General Store	.71	0.00	0.00
Food Stores & Misc.	1.43	0.00	0.00
Automobiles and Tractors	2.42	0.00	0.00
Drinking Places (Taverns & Bars)	1.29	1.20	.50
Implements (Agricultural)	1.14	0.00	0.00
Electric Supply Stores (Sales and Services)	.57	0.00	0.00
Auto body Repair Shops & Garages (1950) or general Automobile repair shops (1970, 1980)	1.57	.40	.25
Variety and Gift Shops	1.57	.40	.50
Funeral Service	.86	.80	.50
General Hardware	.57	0.00	0.00
Plumbing & Heating	1.43	0.00	0.00
Machine Shops & Supplies (1950) motor vehicle dealers (1970, 1980)	.29	1.00	1.75
Confectionery & Misc.	1.00	0.00	0.00
Grain elevator & feed store	1.58	.80	1.00
Furniture Store	.86	.20	.50
Jewelry Store	1.14	.40	.25
Publishing & Printing	.86	0.00	0.00
Auto Supplies (1950); auto- mobile equip. parts & battery, tire and accessory dealers (1970, 1980)	.57	0.00	.75
Shoe and harness repair	.57	0.00	0.00
Oil and Gas or petroleum and related	.43	.40	.75
Radio (Sales, Services)	.57	0.00	0.00
Men's wear	.71	0.00	0.00
Lunchrooms	.43	0.00	0.00
Meat or Meat and fish market	.86	0.00	0.00
Welding and repair	.71	.20	0.00
Dry cleaning and laundry	.57	0.00	.25
Dairy production	.29	.60	0.00
Farm machinery (equip. dealers or supplies)	.29	.60	1.50
Food Lockers	.29	0.00	0.00
Florists (greenhouse)	.29	.20	.50

TABLE 5.15: Cont

Central Functions	Average Number		
	1950	1970	1980
Paint, glass and wallpaper	.29	0.00	0.00
Fuel, coal, feed, etc.	.71	0.00	0.00
Sporting Goods	.43	.60	.50
Bakery & Misc.	.71	.60	0.00
Misc. General Store	0.00	1.20	.50
Women's wear shop	.29	0.00	0.00
Blacksmith	.43	0.00	0.00
Trucking	.43	0.00	0.00
Bowling Alleys	.43	.20	.25
Family Clothing Store	.29	0.00	.50
Violins (Music Store)	.29	0.00	.50
Shoe Store	.14	.40	0.00
Lumber & building material Dealer	0.00	.60	1.25
Motor vehicle dealer	0.00	1.00	1.75
Radio & TV Store	0.00	1.20	.75
General Auto repair shops	0.00	.40	0.00
Women's Ready-to-Wear Stores	0.00	.80	.50
Radio & TV Repair Shops	0.00	.60	.50
House trailer dealers (auto & home supp. store)	0.00	.40	.75
Boat dealers	0.00	.40	.25
Men's & boys' clothing	0.00	.20	.25
Farm and Garden machinery and equip	0.00	0.00	.75
Liquor Store	0.00	0.00	1.00
Construction materials	0.00	0.00	.50
Engineering Service	0.00	0.00	.50
Department Store	0.00	0.00	.25

SOURCE: Tables A.4, A.5, and A.6.

with large urban central places due to regional development); and radio shops, men's wear, and women's wear shops (lost in modifications to other types of functions because of technological change and new lifestyles), disappeared from third order villages over the first period of the study. The general decline of some of the central functions in central villages over the study periods (Table 5.8) included the third order villages in the case of several central functions, such as grocery stores, gasoline service, auto repair shops, hardware stores (1950-1970), grain elevators and feed stores (1950-1970), drugstores, electrical supplies and repair shops, funeral service, jewelry store, and welding repair shops in both periods of study (Tables 5.10 and 5.15). The explanation for these declining functions in third order villages relates to the consolidation of these small retail functions into fewer but larger and more efficient functions in larger towns and cities in southcentral Michigan. It should be noted that transportation development was the important factor in consolidating these functions.

Increases in the number of establishments of some central functions in the central villages studied (Table 5.7) included only a few functions that increased in third order villages, such as machine shops or motor vehicle dealers and farm equipment and farm-and-garden machinery dealers in both periods of study (Table 5.12). Other functions, including

oil and gas and petroleum dealers, sporting goods, radio-TV stores and repair shops, (1970-1980) and house trailer dealers (1970-1980) remained stable typical functions in third order villages (Table 5.12). The retention of these typical functions in third order villages implied their utility for farmers and rural residents who still support such central functions offered in their villages.

Third order villages, as small trading centers, offer agricultural, residential, and recreational functions. The industrial function is most recent and has been developed since the early 1970s. Compared with first and second order villages, the industrial function of third order villages is less important, newer and smaller in third order villages. Agricultural functions as important attractions of third order central villages, makes available important farm needs including grain elevators with their related services such as feed for farm animals and fertilizers for crops, and electrical grain driers. Milling companies, milkers and supplies, silo services and canning companies are vital farm-oriented services for farmers. According to the public questionnaires, about 54 percent of farmers in the hinterlands visit these facilities in third order villages, the rest of the farmers bypass these villages for larger centers. Housing development in the third order villages has begun since the early 1970s and was due to increased non-farm population who commute between their homes and their

jobs. Less expensive housing in these villages has attracted low income young couples or the elderly. Recreational functions have emerged in some of the third order villages such as Lake Odessa and Grass Lake due to their natural endowments. Generally, third order villages offer few employment opportunities, and some have lost several businesses over the study periods. Competition with larger centers' retail businesses has been very harmful for third order villages, because local retailers cannot afford volume buying and greater variety, so lesser quantity and quality at higher prices characterizes local goods, with consequent failure to compete successfully with retailers in larger central places.

Social and public rural services, except schools, have emerged and increased in third order villages (Table 5.19). It may be noted that most of the social and public rural services at the local level in third order villages are surviving and increasing, while businesses at this local level are declining and in danger of disappearing, due to competing spatial interactions between the central places of a region. Thus, future economic development in third order villages is unlikely.

Functional Changes of Fourth Order Villages

The development of fourth order villages has not been stable over the periods of the study (Table 5.1),

particularly their significant decline in retail and wholesale establishments in both periods (Table 5.9) that has decreased their economic viability. Numerous central functions shown in Table 5.11 have disappeared from fourth order villages due to technological change and regional development, as discussed earlier for third order villages.

While central functions (Table 5.6) such as grocery stores, gasoline service stations, auto repair shops, drugstores and furniture stores declined in fourth order villages over the study periods (Tables 5.10 and 5.16), almost all of them (except auto repair shops) retained their status as a typical central function in fourth order villages and continued to support, to some extent, the economic viability of these villages. As in the third order villages, hardware stores declined in the first period in fourth order villages but saw growth in the second period (Table 5.10). Therefore, hardware stores as typical functions in fourth and third order villages have been retained and some have even grown. Grain elevators and feed stores declined also but remained a typical function and stabilized over the combined study periods (Table 5.10). Other declining functions, including electrical supplies and repair shops, plumbing and heating, confectionery, auto supplies and equipment, dry cleaning and dairy product stores were typical functions of fourth order villages in 1950, but had lost their typical positions in those villages by 1970, and had almost

TABLE 5.16: Typical Central Functions Available in Fourth Order Villages: 1950, 1970 and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery store	3.40	2.43	1.67
Gasoline Service Station (Filling & Service Station)	5.3	3.43	.67
Hardware Store	1.50	1.29	1.33
Eating Place (Restaurant)	1.70	1.14	.83
Drugstore	1.34	1.00	.50
General Store	1.17	0.00	0.00
Food Stores & Misc.	1.17	0.00	0.00
Automobiles & tractors	1.50	0.00	0.00
Drinking Places (Taverns & Bars)	.50	.86	.83
Implements (agricultural)	.83	0.00	0.00
Electric supply stores (Sales and Services)	1.17	.14	0.00
Variety & Gift shops	1.17	1.00	.67
Auto body repair shops & garages (1950) or general automobile repair shops (1970, 1980)	1.17	.43	.17
Funeral services	.67	1.00	0.00
General Hardware	.83	0.00	0.00
Plumbing and Heating	1.17	0.00	0.00
Machine shops & Supplies (1950); motor vehicle dealers (1970, 1980)	1.00	1.28	.34
Confectionery & Misc.	.67	0.00	0.00
Grain elevator and feed store	1.01	1.15	.83
Furniture Store	.34	.86	.50
Publishing & Printing	.67	0.00	0.00
Auto supplies (1950); auto-mobile equip. & parts & battery, tire & accessory dealers (1970, 1980)	.34	.14	.17
Shoe and harness repair	.67	0.00	0.00
Oil & Gas or petroleum and related	.50	.42	.34
Radio (Sales and Service)	.67	0.00	0.00
Men's Wear	.34	0.00	0.00
Lunchrooms	.67	0.00	0.00
Dry cleaning and laundry	.34	.29	0.00
Dairy product store	.50	.29	0.00
Farm machinery (equip. dealers or supplies)	.34	1.43	.50
Food lockers	.50	0.00	0.00
Florist (greenhouse)	.67	.57	.33
Sporting Goods	.34	.43	.17

TABLE 5.16: Cont

Central Functions	Average Number		
	1950	1970	1980
Flour milling	.34	0.00	0.00
Vegetables	.34	0.00	0.00
House furnishings	.34	0.00	0.00
Lumber & Building materials dealer	0.00	1.29	.67
Radio & TV Store	0.00	.29	.17
Women's Ready-to-Wear Shop	0.00	.29	.17
Bowling Alleys	0.00	.29	.17
Lumber and construction materials	0.00	.29	.17
Department store	.17	.29	0.00
Farm & Garden machinery & equip.	0.00	.29	.83
Retail nurseries	0.00	.17	.33
House trailer dealer (auto & home supp. store)	0.00	.14	.17
Family clothing store	0.00	0.00	.33
Jewelry	0.00	.14	.17
Mobile home dealer	0.00	0.00	.33
Boat dealers	0.00	0.00	.17

SOURCE: Tables A.4, A.5 and A.6

disappeared from the scene in fourth order villages by 1980 (Table 5.10). These central functions were locally oriented in 1950, but due to regional development, they were consolidated into fewer and more specialized units in larger central places by 1970 and 1980.

Among the increasing functions of central villages (Table 5.7) machine shops or motor vehicle dealers and farm equipment and farm and garden machinery, and sporting goods dealers increased in fourth order villages during the first period of the study (Table 5.12). In the second period of the study, these functions declined in fourth order villages, but remained typical functions in those villages, except for sporting goods. Farm equipment and farm-and-garden machinery, which were more typical than motor vehicle dealers in fourth order villages in 1980 (Table 5.12) apparently had greater viability for survival in this size village. It is expected that sporting goods will disappear in the future from this level of village because of its decline to a non-typical function in 1980 (Table 5.12). Meanwhile, some other nontypical functions, such as family clothing store and women's ready-to-wear shops first appeared in fourth order villages in 1970. Among these, family clothing stores became a typical function in 1980 and the other functions remained non-typical (Table 5.12). It should be noted that even though family clothing stores became a typical function in fourth order villages in 1980,

they are likely to be a local function only temporarily, because the shopping travel maps of farm and non farm families (Chapter Six) for this function show high average travel mileage toward big central places. Therefore, this function is unlikely to survive at this level of villages.

Due to great importance of rural housing development in fourth order villages since 1969, some functions such as household trailer dealers (non typical:1970 and 1980) and mobile home dealers (typical in 1980) emerged in these small villages. The continuous existence of boat dealers as a non-typical recreational function in fourth order villages over 1950-1980 (Table 5.12) implied that the recreational activities function in these villages was not typically viable.

Fourth order villages, as small trading centers, retain agricultural, residential and, to some extent, recreational functions. The few small industries (three manufacturing functions per village) stabilized or declined over the 1970s. Local elevators are dying, because only 50 percent of farmers use the local elevators and related services in fourth order villages. The rest of the farmers, using their own trucks, patronize larger elevators in higher order cities (such as Charlotte). However, elevators, feed mills, farm equipment, and farm and garden machinery dealers, hardware stores and eating places remain functions of fourth order villages for farm families. Rural public services

have been added in the case of churches, banks, doctors, dentists and veterinarians. But schools, barber shops, and attorneys have declined (Table 5.19). The decline of schools is related to school consolidation, but the decline of barber shops has been due to their economic failure. The decline of attorneys is likely to be only temporary and will increase again, because it appeared as a typical function in fifth order villages in 1980. The future of fourth order villages will not be prosperous, due to significant declines in their central functions (establishments) resulting from rural development that enhanced the mobility of rural people and increased the spatial competition between the central places in the study area.

Functional Changes in Fifth Order Villages

Fifth order villages were unstable in their development. For example, they grew slightly in number from 1950 to 1970 and then declined precipitously from 1970 to 1980 (Table 5.1). The reduction in fifth order villages in the last period was related to a large shift of several fifth order villages downward to sixth order villages (Table 5.3). The average number of establishments declined dramatically in fifth order villages in 1950-1970 (-51.72 percent) and increased somewhat (13.33 percent) in 1970-1980. (Table 5.5). This revealed that fifth order villages dramatically declined in their central functions in the first period of

the study, when rural development was occurring swiftly in southcentral Michigan. An increase in average number of establishments in fifth order villages from 1970 to 1980, upgraded this average value from 11.25 to 12.75 but this was still too low for classification of a central place as a viable village. For example, the average number of establishments required is close to 9.9 for minimum, convenience trade centers according to Hodge's (1965) empirical study of Saskatchewan. Therefore, the viability of fifth order villages of the study area is questionable in spite of some gains in the 1970-1980 period. The functions that disappeared from fifth order villages in 1950-1970 included general stores, food stores, general hardware, publishing and printing, shoes and harness repair, radio shops, food lockers, blacksmithing (Table 5.11), electrical supply stores, welding and repair, dairy products and poultry and well drilling (Table 5.17). As explained earlier for other classes of central villages, technological advancements and regional development brought changes in the lifestyles of rural residents, which were responsible for this decline in the viability of fifth order villages.

Among the declining functions (Table 5.10), grocery stores, gasoline service stations, hardware stores, and grain elevator and feed stores had been typical in fifth order village functions, while drugstores and funeral services were typical in 1950 and 1970, and then became

TABLE 5.17: Typical Central Functions Available in Fifth Order Villages: 1950, 1970, and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery Store	4.20	1.33	1.75
Gasoline Service Station (Filling and Service Sta.)	3.10	1.42	.75
Hardware stores	.80	1.08	.62
Eating Places (Restaurant)	.64	.33	.87
Drugstores	.91	.42	.20
General Stores	1.18	0.00	0.00
Food Stores & Misc.	.82	0.00	0.00
Automobiles	.55	0.00	0.00
Drinking Place (Taverns & Bars)	.36	.75	.62
Implements (Agricultural)	.64	0.00	0.00
Electric Supply Stores (Sales & Service)	.73	0.00	0.00
Autobody repair shops & gar- ages (1950) or general auto- mobile repair shops (1970- 1980)	.73	.08	0.00
Funeral Services	.64	.33	.12
General Hardware	.64	0.00	0.00
Plumbing & Heating	.36	.08	0.00
Machine Shops & Supplies (1950)			
motor vehicles (1970, 1980)	.55	0.00	.62
Grain elevator and feed store	.81	.66	.50
Furniture store	.36	.25	.12
Jewelry store	.27	0.00	0.00
Auto supplies (1950); auto- mobile equip. & parts and battery, tire and accessory dealers (1970, 1980)	.36	.16	.12
Shoe and harness repair	.27	0.00	0.00
Oil and gas or petroleum and related	.36	.33	.25
Radio (Sales & Service)	.27	0.00	0.00
Lunchrooms	.36	0.00	0.00
Welding and Repair	.27	0.00	0.00
Women's & Children's dry goods	.27	0.00	0.00
Farm machinery (equip. dealers or supplies)	.09	.25	.25
Dairy products and poultry	.27	0.00	0.00
Well drilling	.27	0.00	0.00
Lumber & building material dealer	0.00	.92	.37
House trailer dealer (Auto & home supp. store)	0.00	.08	.25

TABLE 5.17: Cont

Central Functions	Average Number		
	1950	1970	1980
Farm and garden machinery and equip.	0.00	0.00	.62
Florists	0.00	0.00	.50
Sewing Store	0.00	0.00	.37
Misc. home furnishing store	0.00	0.00	.37
Mobile home dealers	0.00	0.00	.25

SOURCE: Tables A.4, A.5, and A.6.

atypical functions for fifth order villages in 1980. Furniture stores and auto supplies and equipment were typical only in 1950 in these villages (Table 5.10) and atypical thereafter. Among the increasing central functions (Table 5.12) only motor vehicle dealers and farm equipment and farm-and-garden machinery dealers were typical central functions of fifth order villages in 1980, which meant that these two functions were still viable in those villages. The importance of the increasing dormitory (residential) function in fifth order villages caused the emergence of related central functions such as house trailer dealers (1970) and mobile home dealers (1980) (Table 5.12). The emergence of sewing stores as a typical function in fifth order villages in 1980, may have been related to the increased popularity of home tailoring among rural housewives to supplement the family's budget.

Fifth order villages as small trading centers are both agricultural and residential villages. The local elevators and related services are still important for farmers of the hinterlands. About 48 percent of local farmers visit fifth order villages for their elevator and related services, while the rest of them bypass these villages for larger elevators in other central places. Milling, grain storage, and markets, feed grinding, farm related machinery and implements' dealers, and hardware stores are the vital and important functions to farmers who visit these villages. The

residential functions of the villages increased with new housing development for new residents since the early 1970s. Minimal industry (an average of three industrial functions per village) existed, but was not developed further. Schools, churches, banks and doctors were typical functions in these small communities up to 1970, and dentists, attorneys and veterinarians were added to them by 1980 (Table 5.19). These represent the increased demands of rural non-farm families who increased the populations of these villages and their hinterlands. The future viability of fifth order villages is unlikely because of competing spatial interaction with urban and larger central places that are more attractive and practical for farm and nonfarm families of these villages and their surrounding hinterlands.

Functional Changes of Sixth Order Villages

Sixth order villages, as the lowest order villages in the hierarchical structure of the central villages studied, have demonstrated instability in the changes to their numbers over the study periods (Table 5.1). Indeed, their loss of central function establishments (average values) in both periods of study (-53.9 percent in 1950-1970, and -41.27 percent in 1970-1980) represented the greatest amount function loss among the various classes of central villages (Table 5.5). The average number of functional establishments in sixth order villages was 15.4 in 1950, 7.1 in 1970

and 4.17 in 1980 (Table 5.5). The decline in average number of establishments (stores) in sixth order villages to 4.17 in 1980, put them at the "hamlet" level that is the lowest ordered class in a central place system. According to Hodge's work (1965) on trade centers of Saskatchewan, the average number of establishments was 3.3 per hamlet, and hamlets were categorized with five establishments (for commercial or cultural purposes), in the work of Brush (1953) on the central places of Wisconsin. Therefore, these sixth order villages, whose central functions significantly declined, lost their village positions in the period of 1970-1980, and were downgraded to hamlet level in 1980.

The sixth order villages, like the other classes of villages studied, were faced with declining and vanishing functions in the period from 1950-1970 (Table 5.11). The disappearance of those types of central functions have already been discussed as the results of technological change in agriculture and transportation in the study area. Among the vanished functions of sixth order villages were general stores, food stores, and general hardware stores were typical in 1950 (Table 5.11). These functions disappeared due to their outmoded status and competing interactions among the central places of the study area.

In the category of declining functions, grocery stores, gasoline service stations, auto repair shops, grain elevators and feed stores and drugstores declined in both

periods of the study (Table 5.10). Grocery stores, gasoline stations and grain elevators and feed stores became non-typical or atypical functions in 1980, while the decline of auto repair shops and drugstores from 1950 to 1970, caused their atypical status in 1970, that remained non-typical in 1980 (Table 5.10). Some other declining functions such as plumbing and heating, confectionery, furniture stores, and welding and repair that were non-typical in sixth order villages in 1950 (Table 5.10) disappeared completely in the later decades. Hardware stores were a declining function (Table 5.8) in 1950-1970 in sixth order villages, but increased in the second period (Table 5.10). Hardware stores were thus consistently (1950, 1970, 1980) a typical function in sixth order villages. In the case of growing (increasing) functions, only farm equipment and farm and garden machinery (Table 5.12) and lumber dealers and drinking places (Table 5.18) maintained typical status in sixth order villages.

Among the rural services, schools, churches and banks were typical in sixth order villages (Table 5.19) but, as in other central villages (except first order villages) local schools were lost due to school consolidation. Banks, churches, lumber companies, hardware stores, refreshments (drinking places) and restaurants remained attractions of sixth order villages. Due to the decline and disappearance of grain elevators and feed stores in sixth order villages,

TABLE 5.18: Typical Central Functions Available in Sixth Order Villages: 1950, 1970 and 1980

Central Functions	Average Number		
	1950	1970	1980
Grocery Store	1.75	1.20	.22
Gasoline Service Station (Filling and Service Sta.)	2.70	1.13	.28
Hardware Store	1.00	.47	.67
Auto body Repair Shops & garages (1950) or general automobile repair shops (1970, 1980)	1.15	.27	.17
General Store	.65	0.00	0.00
Eating Places (Restaurant)	.65	.20	.11
Drinking Place (Taverns & Bars)	.60	.60	.44
Funeral Service	.40	.80	.11
Drugstores	.40	.20	0.00
Grain Elevator and Feed Stores	.85	.40	.17
General hardware	.35	0.00	0.00
Implements (Agricultural)	.35	0.00	0.00
Electric Supply Stores (Sales & Services)	.30	0.00	0.00
Farm machinery (equipment dealers or supp.)	0.00	.73	.28
Lumber and Building material dealers	0.00	.33	.39
Farm and Garden machinery and Equipment	0.00	.07	.22

SOURCE: Data is derived from Tables A.4, A.5 and A.6

TABLE 5.19: Typical Rural Services Available in Central Villages in 1970 and 1980

Typical Rural Services	Average Number	
	1970	1980
<u>First Order Villages:</u>		
School	3.33	4.00
Church	3.67	10.67
Bank	1.00	2.67
Doctor	3.00	9.67
Barbershop	.67	1.67
Dentist	1.67	3.33
Attorney	2.33	3.67
Veterinarian	.33	1.67
Optometrist	.33	.67
Clinic	.33	1.33
Hospital	0.00	.33
<u>Second Order Villages:</u>		
School	2.50	2.14
Church	3.25	6.71
Bank	1.00	1.43
Doctor	.75	1.86
Barbershop	1.00	1.14
Dentist	1.25	1.57
Attorney	0.00	1.28
Veterinarian	1.00	1.86
Optometrist	0.00	.29
Clinic	0.00	.29
<u>Third Order Villages:</u>		
School	3.40	2.25
Church	4.00	6.75
Bank	1.20	1.25
Doctor	1.40	2.25
Barbershop	1.60	2.25
Dentist	1.20	1.25
Attorney	.60	.75
Veterinarian	.20	1.00
Optometrist	0.00	.75
<u>Fourth Order Villages:</u>		
School	3.00	1.50
Church	3.00	4.50
Bank	1.00	1.17
Doctors	.71	1.17
Barbershop	.57	.50
Dentist	.57	.67
Attorney	.43	.17
Veterinarian	.29	.50

TABLE 5.19: Cont

Typical Rural Services	Average Number	
	1970	1980
<u>Fifth Order Villages:</u>		
School	2.00	1.63
Church	1.00	3.75
Bank	.83	.88
Doctor	.33	.38
Dentist	0.00	.38
Attorney	0.00	.75
Veterinarian	0.00	.38
<u>Sixth Order Villages:</u>		
School	1.00	.61
Church	.80	1.78
Bank	.40	.56

SOURCE: Tables A.7 and A.8

the farmers of the hinterlands visit grain elevators in larger central villages (such as Fowler and Webberville) or urban centers (such as Durand and St. Johns). Therefore, these tiny villages are almost always bypassed by farmers in favor of facilities in larger central places. These villages, as the least important trading centers among the central villages of southcentral Michigan, are small agricultural and residential communities that have very little, if any, manufacturing activities (as an average: one industrial function per village). These villages have had housing development since the early 1980s. The populations of these villages have grown very slightly or even declined, but the rural population in townships surrounding the sixth order villages increased in both periods of study (Figure 3.12). Therefore, housing development was a consequence of population increase, due to new rural nonfarm residents. As explained earlier, sixth order villages became small central places that could only be categorized as hamlets that are nonviable for future economic development. They are likely to continue to support only their dormitory and community functions.

Spatial Distribution of Different Classes of Central Villages in a Process of Change

Spatial Modeling

Christaller and Losch created a hexagonal pattern of marketing among the central places of a region and a

predictable rigid pattern of the range of goods and services as a component of central place theory. However, later contributions relaxed this deterministic concept of original central place theory. The technique of nearest neighbor analysis which can be used to measure the coefficient of dispersion among the dot patterns (settlements) of a region, is an alternative method for determining the range of central places of a study area.

Using nearest neighbor analysis to test a given dot pattern will provide an R value that is called a nearest neighbor index. When $R=0$, the pattern of dots is closely clustered; when $R=1$, the pattern is random, and when $R=2.149$, the pattern is dispersed (Taylor, 1977:157; and Silk, 1979:108). Repeated calculations of the R index over time can thus be helpful for comparing the change in the settlement (dot patterns) of a study area. For instance, variations of the R index in a certain study area over a period of time, can provide a measure of the tendency of settlement patterns toward clustering, randomizing or dispersing. The Z test of R (shown as ZR) at an assumed significance level, can determine whether dot patterns are generated from a clustering process, random process, or dispersing process (nearest neighbor analysis is discussed in detail in Taylor, 1977 and Silk, 1979).

Changes in the functional viability of central villages (functional index values) of the study area over the periods

of 1950-1970 and 1970-1980 caused changes in their spatial distribution in the region (Figures 4.1, 4.2 and 4.3). In order to standardize and compare the dot patterns of each class of central villages in 1950, 1970 and 1980, the technique of nearest neighbor analysis was applied in this research. Thus, it was possible to measure changes in coefficients of dispersion between different classes of central villages at the three points in time (1950, 1970 and 1980). Because the scaled boundary of the study area at the three points in time in this research remained the same, limitations of boundary changes in relationship to dot pattern distribution in a study area were not a concern. Change in the viability of central villages thus changed their spatial distribution in regard to their class hierarchy, but not their geographical situation in the study area (Figures 4.1, 4.2 and 4.3)

Using nearest neighbor analysis, the following hypotheses were tested in this research.

H_0 : The pattern of points in a certain class order (for example, sixth order villages) is random

H_1 : The pattern of points in a certain class order (for example, sixth order villages) is clustered

or

The pattern of points in a certain class order (for example, sixth order villages) is dispersed.

It was assumed that alpha would equal .05 on a two-tailed Z-test and, therefore, Z-critical was ± 1.96 . consequently,

the calcuted ZR values ranging within ± 1.96 or Z-critical were the parameters for determining that a dot pattern was random (acceptance of H_0 , the null hypothesis). ZR values beyond ± 1.96 implied rejection of the null hypothesis and acceptance of H_1 or the alternative hypothesis. ZR values beyond -1.96 thus indicated a clustered dot pottern and those beyond $+1.96$ indicated a dispersed pattern of central villages.

The application of the nearest neighbor test in the central villages of the study area has produced R index values with their related significance levels (significance of ZR). It was applied to determine the dot patterns of central villages of different classes at three points of the study time (Table 5.20). The first and second order vil-lages were noncomputable in 1950, due to the fact that there was only one central village in those classes (Table 5.20). However, the first order villages showed a random pattern in 1970 and 1980. The R index was .52 in both 1970 and 1980 and the random pattern tended toward clustering. The variation of the R index from 1 to zero showed the random pattern with a tendency toward aggregating or clustering (See Taylor, 1977:157). The closeness of first order central villages in 1970 and 1980 (Figure 5) was related to their location in a highly industrialized region with access to super highways connected to Detroit. The second order villages had a dispersed pattern in 1970 and 1980 (Table 5.20 and Figure 5)

TABLE 5.20: Spatial Distribution of Central Villages: 1950, 1970 and 1980*

Villages in Order and Time:		N	R	ZR	Signifi- cance of ZR	Z-Critical P=.05 including .025 on each tail	Dot Pattern
First Order Villages	1950	1	NC**	NC	NC	NC	NC
	1970	3	.52	-1.59	.0559	-1.96	Random
	1980	3	.52	-1.59	.0559	-1.96	Random
Second Order Villages	1950	1	NC	NC	NC	NC	NC
	1970	4	2.09	4.15	.00003	+1.96	Dispersed
	1980	7	1.83	4.20	.00003	+1.96	Dispersed
Third Order Villages	1950	7	1.171	.88	.1894	+1.96	Random
	1970	5	1.167	.72	.2358	+1.96	Random
	1980	4	1.52	2.00	.0228	+1.96	Dispersed
Fourth Order Villages	1950	6	1.48	2.24	.0125	+1.96	Dispersed
	1970	7	1.28	1.43	.0764	+1.96	Random
	1980	6	1.30	1.43	.0764	+1.96	Random
Fifth Order Villages	1950	11	.90	-.65	.2578	-1.96	Random
	1970	12	.80	-1.38	.0838	-1.96	Random
	1980	8	1.38	2.31	.0104	+1.96	Dispersed
Sixth Order Villages	1950	20	1.00	.04	.4840	+1.96	Random
	1970	15	.96	-.33	.3707	-1.96	Random
	1980	18	.90	-.81	.2090	-1.96	Random

*The technique of nearest neighbor analysis has been applied using the data from Figure 2.3, 4.1, 4.2 and 4.3. The approximate area of the study area is M=4919.6 sq. miles (from Figure 2.3).

**Noncomputable in nearest neighbor analysis because there is only one central village in that hierarchical class of central villages in the study area.

Spatial Distribution of Central Villages in 1950, 1970, 1980

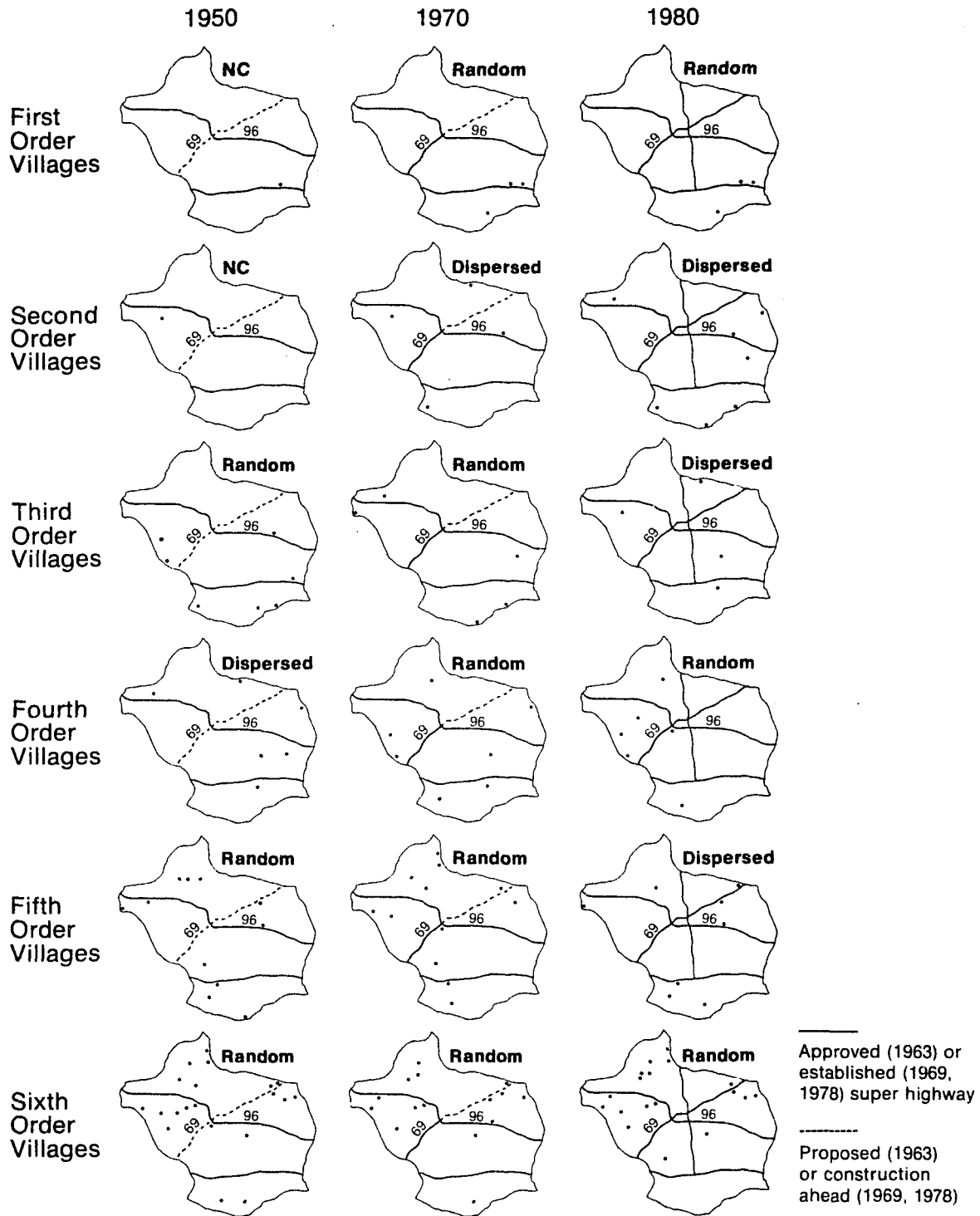


Figure 5.2 The general pattern of central village in the study area and their relative location against the super highway network. The data is collected from Figure 3.10 and Table 4.10.

at a highly significant level of .00003. The decrease in the R index of second order villages from 1970 to 1980 (Table 5.20) shows the greater tendency of the pattern toward randomness. This was related to the increased number of second order villages in the second period of study (Table 5.20). The third order villages had random pattern in 1950 and 1970, but a dispersed pattern in 1980. The observed significance level was .0228 which was very close to critical $P=.025$. Therefore, this dispersed pattern retained some tendencies toward the randomness. Fourth order villages had a dispersed pattern in 1950 at a significance level of .0125, and then showed a random pattern in 1970 and 1980. In fact, the important change in the pattern of their spatial distribution happened from 1950 to 1970 when their dispersed pattern changed to random. The fifth order villages, with a random pattern in 1950 and 1970, changed to a dispersed pattern in 1980 (Table 5.20). The significance level was .0104 which indicated their dispersed pattern in 1980. The great reduction in the number of fifth order villages from 1970 to 1980 accompanied a change in their pattern from random to dispersed. Therefore, the change in the viability of the fifth order villages was accompanied by a change in the pattern of their spatial distribution. The sixth order villages maintained a random pattern in their spatial distribution throughout the study time (Table 5.20). The gradual decline in R indexes of sixth order villages

over the three points of time implied a tendency of the pattern to alter from random toward clustering over time. The great concentration of sixth order villages in the northwest portion of the study area was encouraged by the greater agricultural orientation of that portion than the south, over the three points of the study time (Figure 5) . This encouraged the agglomeration of these least viable villages in that area.

As a conclusion, the results of the nearest neighbor analysis were identical for patterns of central villages studied at the three points in the study time in that the predicted dispersed pattern implied in central place theory was not always associated with the patterns of central villages studied over time. Generally, there were 25 percent of villages with dispersed pattern in 1950, 16.7 percent in 1970 and 50 percent in 1980 (Figure 5) . This meant that the different classes of central villages studied are not always evenly distributed. Changes in their relative location and their class order, due to rural and regional development in the study area over time, were influential in changing their settlement patterns. The wide existence of random patterning among 83.3 percent of the villages in 1970, may have been caused by the revolutionary period in the region's rural development from 1950 to 1970.

Regional Development and Spatial Components

The development of local village networks and their connection to regional highways and super highways in south-central Michigan, upgraded the mobility of rural residents over the past three decades. Among the farm and nonfarm families interviewed, average weekly visits to a market center were increased at the time the study was done compared with the past. It was apparent that the increased mobility of these rural families was associated with an increase in regional accessibility due to super highway development in the study region.

Agricultural industrialization in association with technological advancements and significant super highway development and consequent change in population patterns in southcentral Michigan were influential in the disappearance of some rural central functions, the decline of some of the others, and, finally, the increase or emergence of other functions in the central village studied over the study periods. The consequences of the change in central functions have been changes in the villages' viability and created particular spatial distributions for each class of central villages at different points in time (Figure 5). The growth and spatial distribution of central villages in the southern part of the study area (situated south of the intersection of I-69 and I-96: Figure 5), created an urban industry-oriented district dominated by the auto industries

of Detroit, that varied from others. Hart (1972:278) has noted that the Illinois-Indiana line divides the urban/industrial middle west, with the eastern part dominated by Detroit and auto-manufacturing and the western part dominated by agriculturally-oriented industries. The southern part of the study area, particularly the southeast, was dominated by auto industries and related manufacturing. The southern districts of the study area of this research (situated south of the I-69 and I-96 intersection) was an immediate contact (using I-96 and/or I-94) with Detroit (Figure 3.10) and its related auto industries. These situational factors encouraged the development of light industry in the central villages situated in that part of the study area.

First order and second order villages have increased in this southern part of the study area over the study period. First order villages were always located in the southern part of the area (1950, 1970 and 1980). Second order villages were not seen in southern part of the area in 1950, but there was one second order village there in 1970, and four in 1980 (Figure 5). Regarding the growth of manufacturing functions in first and second order villages over the study time, it should be noted that the relative locations of these villages have been important in their spatial distribution.

Third, fourth, fifth and sixth order villages declined in their numbers south of the I-69 and I-96 intersection

over the study time (Figure 5) . There were four third order villages in this southern part in 1950, three in 1970 and two in 1980. Among fourth order villages, there were three of them in the southern area in 1950, three of them in 1970, and two of them in 1980. Four of the fifth order villages were in the southern part in 1950, four in 1970 and three in 1980. Four sixth order villages were in the southern part in 1950, but declined to two in 1970 and 1980 (Figure 5) . These observations show that the third, fourth, fifth and sixth order villages were not as likely to be retained as the first and second order villages in their development in the southern part, south of the I-69 and I-96 intersection.

The northern part of this study area was more agriculturally-oriented and more favorable for the lower order central villages over the study time. It may be speculated that in the future, viable villages will continue to develop in the southern part of study area, and non-viable ones will be likely to belong to the northern part of the study area.

As a final point, it should be noted that because this research is also concerned with the impact of the shopping behavior of farm and nonfarm families in changing the viability and spatial distribution of the central villages studied over the study time, the consumer characteristics that influenced the range of sampled goods and services are discussed in Chapter Six.

CHAPTER SIX

A SOCIOECONOMIC ANALYSIS OF FARMERS' PREFERENCES IN ESTABLISHING BEHAVIORAL RANGES FOR CENTRAL VILLAGE GOODS AND SERVICES

Range Of Goods And Services

The concept of the range of a good or service is a component of classical central place theory (discussed in Chapter One). It involves consumer distance minimization within a hexagonal (regular) pattern of marketing. The deterministic aspect of original central place theory is relaxed and modified to permit probabilistic interpretations that explain consumers' behavioral patterns toward different goods and services. Classical central place theory concerns regular patterns of central places, rather than including socio-psychological elements that influence consumer perceptions and preferences (Blommestein, Nijkamp, and Veenendaal, 1980:160). Contributors to revised central place theory have examined the influence of these consumer characteristics in their shopping preferences for a certain function at a certain central place.

In relation to the biased preferences of consumers, the spatial range of goods and services may be spatially

flexible (competitive functions) or spatially inflexible (convenience functions). Consumers' preferences for shopping in a particular store have been found to be influenced by consumer characteristics and subjective and objective factors in recent studies of revised central place theory. In this chapter, the shopping preferences of the farm and nonfarm families of the study area for selected functions in a certain central place, are reported in examining rural families' characteristics, and their subjective and objective shopping choices.

Procedure

In order to visualize the shopping travel model of farm and nonfarm families toward the sampled functions, data were collected from field survey questionnaires of 90 farm families and 90 nonfarm families in this research (Appendix B). Figures 6.1.1 and 6.1.2 show the locations of the selected rural families who participated in this survey. For each sampled function, one shopping travel map for farm families and another for nonfarm families have been provided. To measure and compare the mileage travelled by the rural families for each sampled function, descriptive statistical methods were used to determine averages and standard deviations.

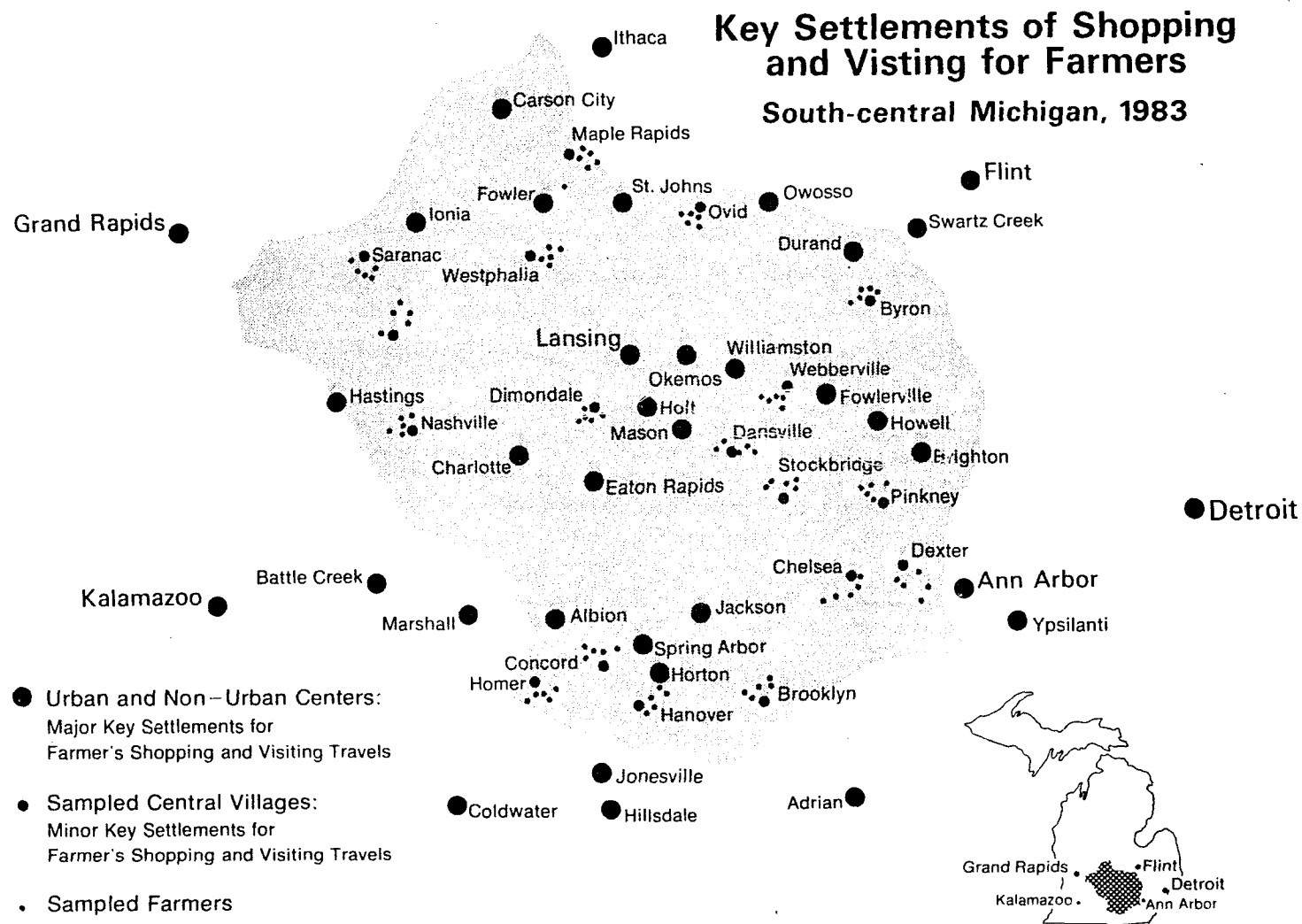


Figure 6.1.1 The key settlements of urban and rural centers for shopping or visiting travel models of farm families samples.

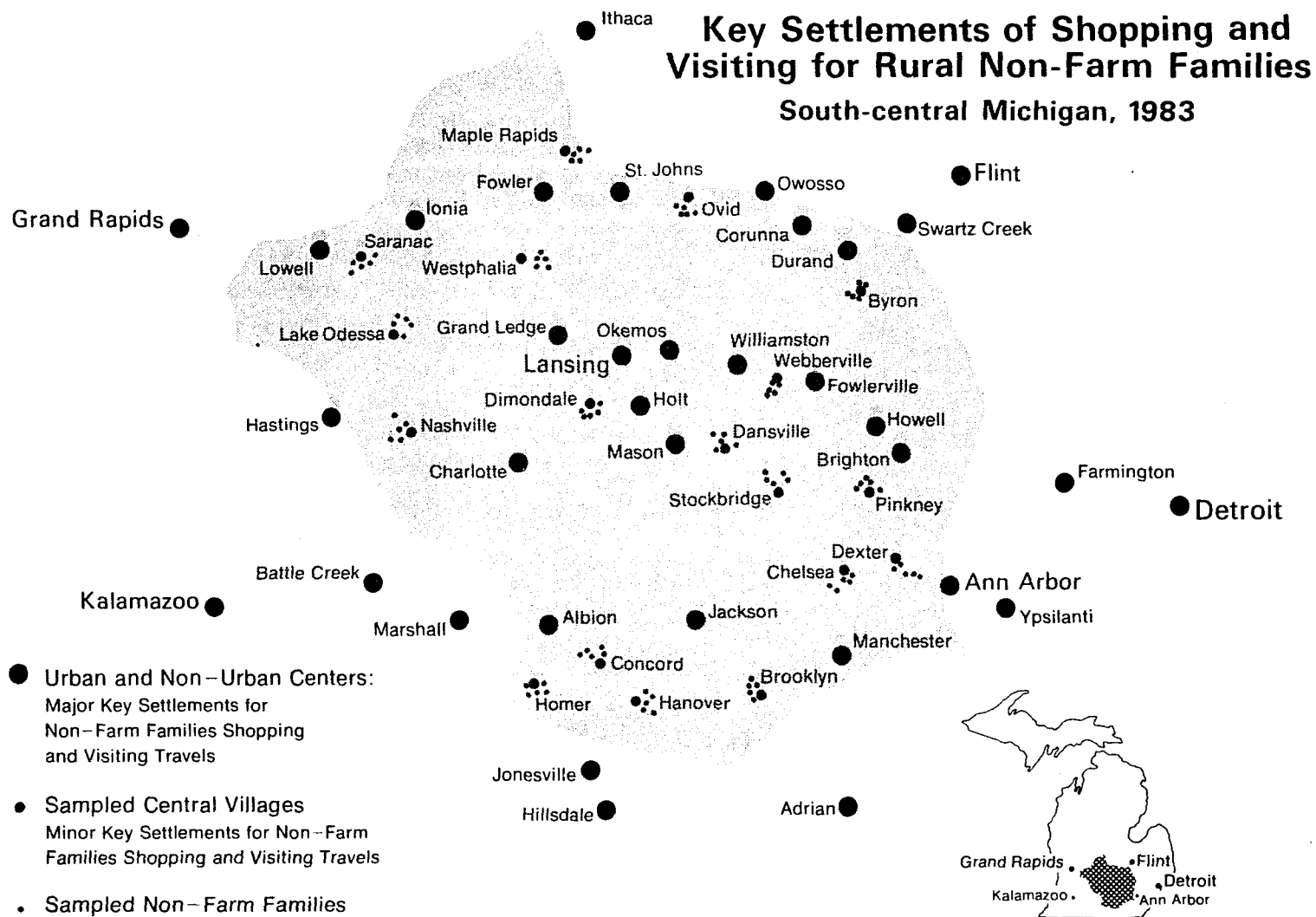


Figure 6.1.2 The key settlements of urban and rural centers for shopping or visiting travel models of non-farm families sampled.

For determining the factors (subjective or objective) that were statistically significant in an individuals' shopping choice behavior for a certain function in a certain central place, the chi-square test,¹⁴ an inferential statistical technique, has been used exclusively for each individual factor (Tables 6.1.1. and 6.1.2). The examined factors are sorted on a chi-square probability scale according to their probability of association with rural families' selection of a certain function in a certain central place (Figure 6.1.3). The scale of observed probability ranges from 0 to 1.00 (Figure 6.1.3), but only factors located between 0-.05 are statistically significant (at the 95 percent confidence level). Detailed information of chi-square tests applied in this research is presented in Appendix C, while chi-square probability scales and the coefficients of Phi and Cramer's V are presented in this Chapter.

The null hypothesis predicts no association between a certain factor (such as age, distance, saving money,...etc.) and the rural families' shopping selection of a certain function (such as grocery, department store, automotive dealer,...etc) in a certain central place, while the

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To determine the strength of association between the two variables examined by a chi-square test, Cramer's statistic for larger tables (more than 2x2) and the Phi-coefficient for small tables (2x2) that indicate the greater amount of strength of association were used. Both Cramer's statistic and the Phi-coefficient vary from 0 to 1; a greater value implies stronger association (Winkler and Hays, 1975:833-835; and Klecka, Nie and Hull, 1975:78-81).

TABLE 6.1.1: A Pilot Pattern* for a Chi-Square Test: Examining the Association Between the Age of Farmers and Their Selection of a Grocery Store in a Certain Central Place

Age Groups	Central Places						
	Other Places	1st Order Villages	2nd Order Villages	3rd Order Villages	4th Order Villages	5th Order Villages	6th Order Villages
Under 25	****	****	****	****	****	****	****
25-55	****	****	****	****	****	****	****
Over 55	****	****	****	****	****	****	****

$$\chi^2 = ? \quad df:12 \quad \text{Probability of association} = ? \quad \text{Cramer's V} = ?$$

*In practical Chi-square tests of this research, the columns and rows are combined when there are expected frequencies less than five in a cell or cells of the contingency table. This effort improves the accuracy of the test. Most of the tables examined in this research included small degrees of freedom.

TABLE 6.1.2: A Pilot Program of Factors Related to Farmers' Selection of Grocery Store in Central Places

Factors	Chi-Square	df	Observed Probabilities	Cramer's V or Phi-Coefficient
<u>Objective Factors</u>				
Convenience of Shopping	*	*	.20 > P > .10	*
<u>Subjective Factors</u>				
Save Money	*	*	.50 > P > .20	*
<u>Individual Characteristics</u>				
Income	*	*	.10 > P > .05	*
Age	*	12	.05 > P > .01	*
Length of Residence	*	*	.05 > P > .01	*
Trips per Week	*	*	.70 > P > .50	*
Full Time or Part-time Farming	*	*	1.0 > P > .70	*
Type of Farming	*	*	.05 > P > .01	*

Factors Related to Farmers' Selection of Grocery Stores in Certain Central Places

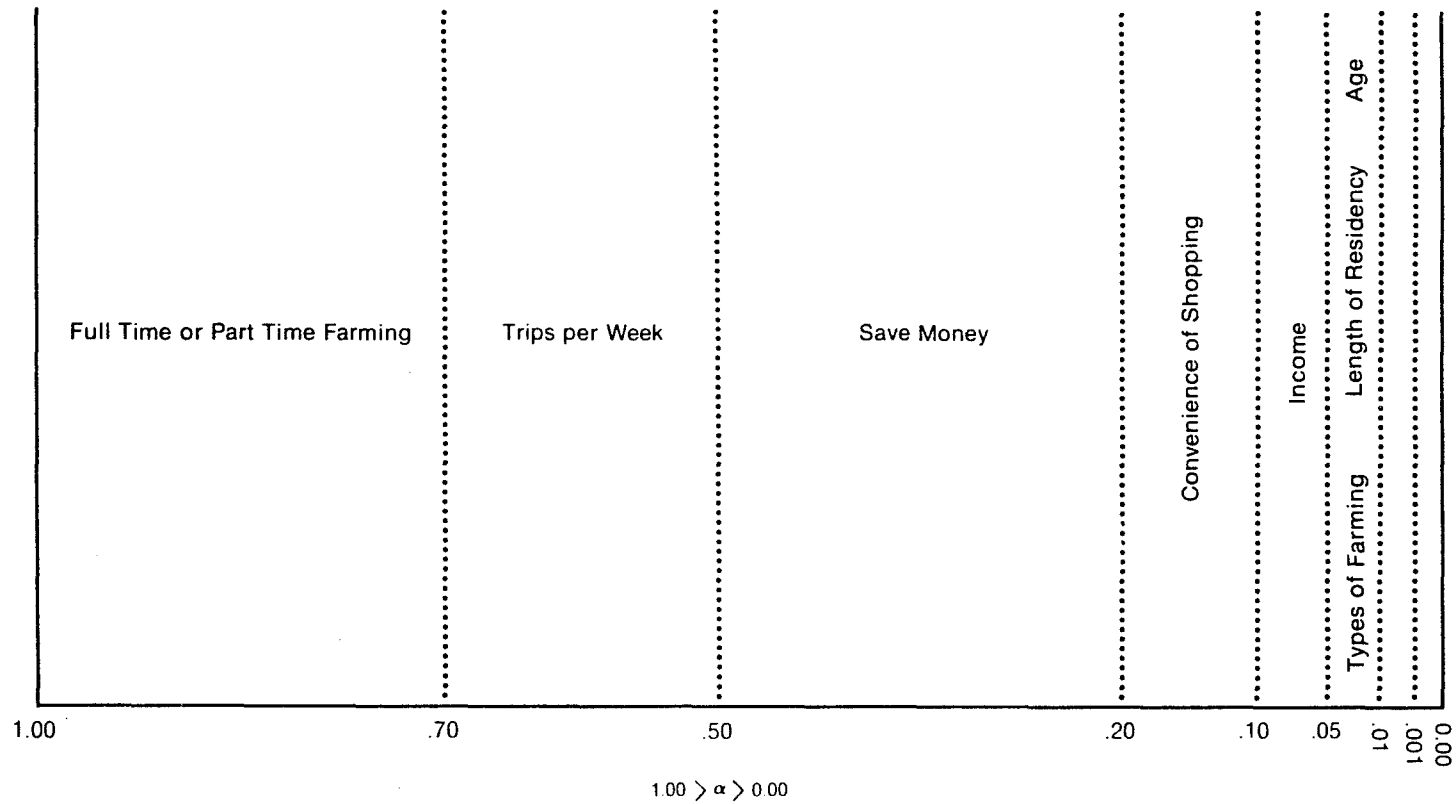


Figure 6.1.3 A pilot pattern of chi-square probability scale for grocery function. Factors of "types of farming", "length of residency", and "age" are statistically significant of having association with the selection of grocery stores in particular central places. Other factors are not statistically significant.

alternative hypothesis implies an association between those variables. Therefore, assuming a significance level equal to .05, those factors ranged on the right side of .05 on the probability scale figure (Figure 6.1.3) show a statistically significant association with the choice behavior of rural families (accepting the alternative hypothesis), while the rest of the factors that are ranged on the left side of .05 line (Figure 6.1.3) do not have a statistically significant association with the choice behavior of rural families (accepting the null hypothesis).

Sampled Goods and Services

The sampled goods and services (rural functions) in the research field survey (Appendix B) were selected from a classified list of the location coefficient values of rural functions offered in central places in 1980 (Table 2.3). There were ten such classifications and one rural function was selected randomly from each strata or class (Table 2.4). The shopping behavior of farm and nonfarm families was then surveyed in regard to ten selected functions. Models of rural families' shopping travel behavior for each of these sampled rural functions have been provided (through the field survey data) showing the behavioral range of that function. The mean values and standard deviations of the mileage travelled by rural families for each function were calculated to determine the different consumer behavioral

ranges for the sampled functions. The hypothesized factors (subjective, objective, personal characteristics) influencing those shopping travel models were also determined by their chi-square values and the coefficients showing strength of association (Cramer's v and Phi-coefficient) on the related tables. Moreover, those factors examined in the chi-square tests, were sorted on the figures of related chi-square probability scales.

In order to explain the spatial distribution of sampled functions and consumers' (rural families') preferences toward these functions, the ten sampled functions are arranged in regard to their existence in the class order of central villages. For instance, the grocery store function was typical in all classes of central villages, so it is called a sixth order village function. The clinic and optometrist functions were typical in first, second, and third order village functions, therefore they are termed third order village functions in this research. Jewelry and floor covering stores were found to be second order village functions, paint and department stores were first order village functions and family clothing, automotive dealers and shoe stores were town and city level functions. The ten sampled functions are thus discussed in five separate

sections according to their position as typical functions in
¹⁵
 certain classes of central villages.

Sixth Order Village Functions

Among the sampled functions in this research, the grocery store function with a 1.54 location coefficient was the lowest order function and was almost typical in all of the classes of villages in 1980 (Table 6.2). The grocery store function was typical in sixth order villages in 1950 and 1970, but its average number in sixth order villages in 1980 (.22) was only "near typical".

As was discussed in Chapter Five, sixth order villages by 1980 had declined in viability to the hamlet level. However, food services (grocery) tend to remain viable at the hamlet level (Ray, 1967:145) or the village level (Berry, Barnum and Tennant, 1962:79) and have been shown to have the lowest range of consumer travel mileage in some empirical studies (Murdie, 1965; Ray, 1965; Golledge, Rushton and Clark, 1966). In this research, also, the range of shopping travel for grocery stores among both farm families (Figure 6.2.1) and nonfarm families (Figure 6.2.2) was shown to be lowest, compared with the other sampled functions

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As noted in Chapter Five, typical functions for this research are those that are available in at least one-third of the villages of a certain class. Therefore, the existence of at least one-third or .33 functional unit of a function per class of villages defined a typical function for that class of villages.

TABLE 6.2: Distribution of Functional Units (N) and Average Number of Sampled Functions in Central Villages: 1980

Types of Functions	Functional Units (N)	Location Coefficient (L.C.)	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
			N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.
Grocery Store	65	1.54	11	3.67	19	2.71	7	1.75	10	1.67	14	1.75	4	.22
Optometrist Clinic	9	11.11	2	.67	2	.29	3	.75	0	0.00	1	.13	1	.06
	8	12.50	4	1.33	2	.29	1	.25	0	0.00	1	.13	0	0.00
Floor Covering Store	6	16.66	2	.67	3	.43	0	0.00	0	0.00	1	.12	0	0.00
Jewelry Store	7	14.28	4	1.33	2	.29	1	.25	0	0.00	0	0.00	0	0.00
Paint & Wall- paper Store	4	25.00	1	.33	1	.14	0	0.00	0	0.00	1	.12	1	.06
	3	33.33	2	.67	0	0.00	1	.25	0	0.00	0	0.00	0	0.00
Department Store														
Family Cloth- ing Store	5	20.00	0	0.00	1	.14	2	.50	2	.33	0	0.00	0	0.00
Automotive Dealer	2	50.00	0	0.00	0	0.00	0	0.00	1	.17	1	.12	0	0.00
Shoe Store	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	1	.12	0	0.00

SOURCE: Data is selected from Tables A.7 and A.8

**Farmers' Shopping Travel:
Grocery Store**
South-central Michigan, 1983

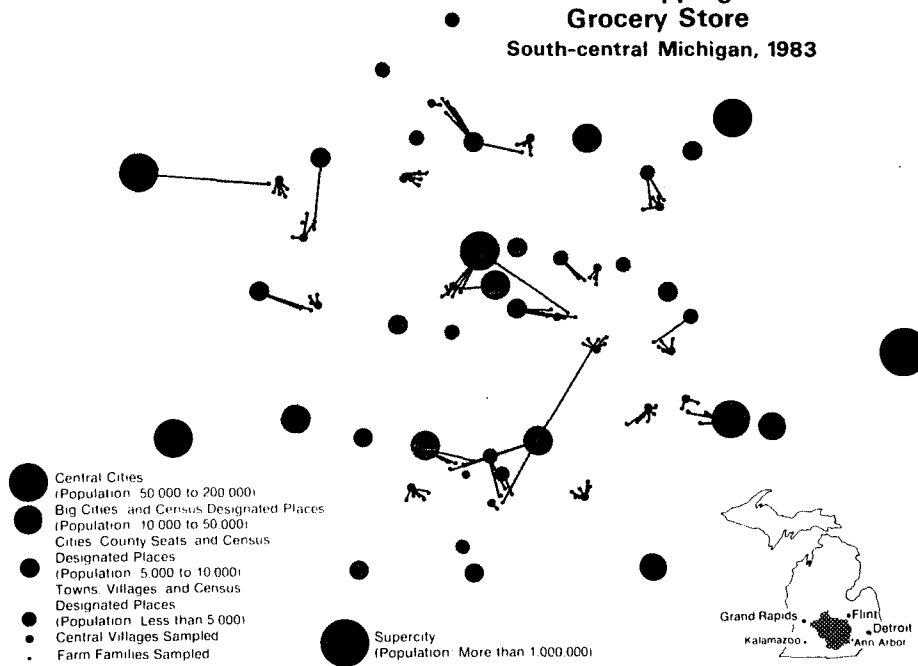


Figure 6.2.1 Shopping travel model of farm families
sampled for grocery stores.

**Rural Non-Farm Families' Shopping Travel:
Grocery Store**
South-central Michigan, 1983

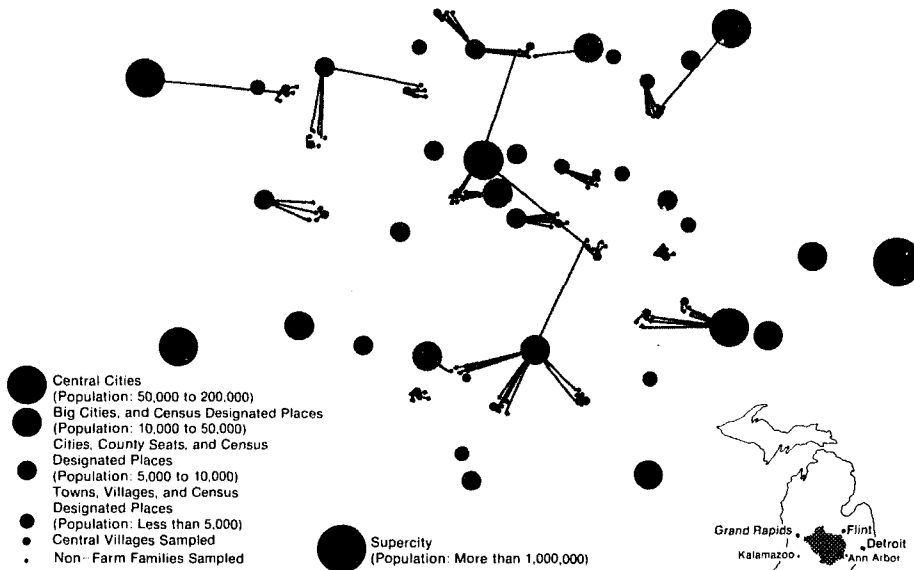


Figure 6.2.2 Shopping travel model of non-farm families
sampled for grocery store.

(Table 6.3). This implied that in the central villages studied, grocery stores were still supported by local farm and nonfarm families with a good percentage of grocery in-shopping. However, the greatest percentage of local grocery shopping was done by farm families (Table 6.3.1). It is apparent that further increases in rural nonfarm population will mean declines for most of these local grocery stores. Therefore, sixth order villages may lose this function in the future. Functions in the same class of location coefficients (Table 2.3), such as churches, hardware stores, eating places and grain elevators, may face the same future in sixth order villages.

In order to determine the factors influencing the range of grocery stores, the results of chi-square probability tests are shown in Figures 6.2.3 and 6.2.4. According to those figures, the factors of distance, age, length of residency and types of farming were statistically significant for selection of grocery stores by farm and nonfarm families in central places. Distance, at a significance level between .001-0, with a strong Phi-coefficient, was the most important factor, among both farm and nonfarm families, for grocery shopping (Tables 6.4.1 and 6.4.2 and Figures 6.2.3 and 6.2.4). This meant that rural families value the proximity of a central village for their grocery shopping. Length of residency was also an important factor in the grocery shopping model among both farm and nonfarm families

TABLE 6.3: Farmers and Nonfarmers' Travel Mileage for Sampled Functions, by Descriptive Statistical Values

Sampled Functions	Farmers		Nonfarmers	
	Mean	Standard Deviation	Mean	Standard Deviation
Grocery Store	5.22	4.40	6.80	5.60
Optometrist	11.90	6.30	12.90	7.60
Clinic	9.10	5.90	12.66	9.40
Floor Covering Store	13.90	7.70	15.14	8.03
Jewelry Store	13.50	7.20	13.08	7.90
Paint & Wallpaper Store	11.20	7.00	14.60	8.90
Department Store	14.40	7.50	14.53	8.90
Family Clothing Store	15.50	7.40	14.60	7.60
Automotive Dealer	10.40	6.50	13.07	11.70
Shoe Store	15.10	8.40	16.06	8.75

SOURCE: Data is collected from the farm and nonfarm families' survey questionnaires (Appendix B).

TABLE 6.3.1: Percent of Outshopping and Inshopping by Rural Families for the Sampled Functions

Sampled Functions	Farm Families		Nonfarm Families	
	Percent of Outshopping (Urban Centers)	Percent of Inshopping (Central Villages)	Percent of Outshopping (Urban Centers)	Percent of Inshopping (Central Villages)
Grocery Store	42.0	58.0	64.9	35.1
Optometrist Clinic	85.4 67.0	14.6 33.0	87.5 74.4	12.5 25.6
Floor Covering Store	91.4	8.6	94.5	5.5
Jewelry Store	90.5	9.5	93.75	6.25
Paint & Wallpaper Store	82.3	17.7	88.7	11.3
Department Store	85.1	14.9	90.9	9.1
Family Clothing Store	94.1	5.9	97.7	2.3
Automotive Dealer	70.2	29.8	81.0	19.0
Shoe Store	89.9	10.1	97.6	2.4

SOURCE: Data are derived from the farm and nonfarm families' survey questionnaires (Appendix B) which were collected in the summer of 1983 by the researcher.

Factors Related to Farmers' Selection of Grocery Stores in Certain Central Places

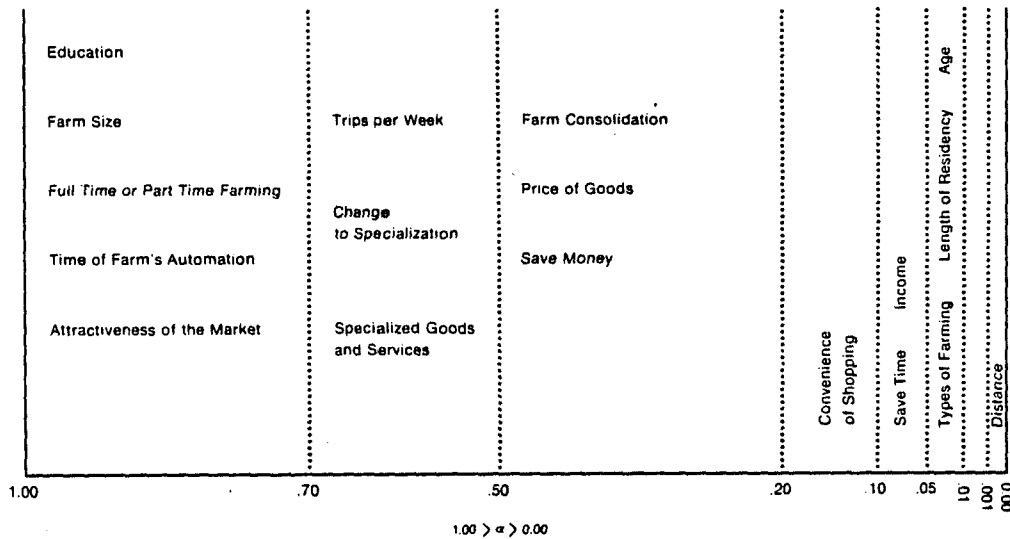


Figure 6.2.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of grocery stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of grocery stores.

Factors Related to Non-Farmers' Selection of Grocery Stores in Certain Central Places

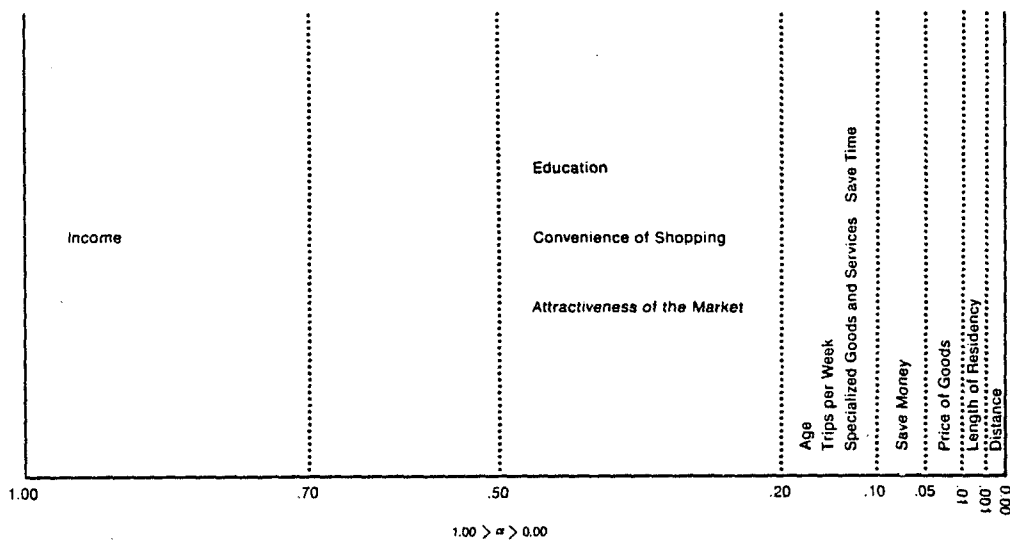


Figure 6.2.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of grocery stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of grocery stores.

TABLE 6.4.1: Factors Related to Farm Families' Shopping Travel Models for Sampled Functions: Cramer's V and Phi-Coefficient

Factors/Functions	Grocery Store	Opto-metrist	Clinic	Floor Covering Store	Jewelry	Paint & Wall-paper	Department Store	Family Clothing	Auto-motive Dealer	Shoe Store
<u>Objective Factors</u>	Cramer's V and Phi-Coefficients*									
Distance	.41496	.30496	.41100	.17324	.21437	.16647	.10295	.08032	.52503	.16053
Price of Goods	.18036	.07788	.13561	.20842	.17171	.19421	.31183	.35093	.22235	.33743
Specialized Goods/Services	.09759	.41989	.41197	.19742	.20599	.08047	.14173	.11578	.21707	.27907
Shopping Convenience	.20576	.20965	.24425	.11114	.12193	.23158	.26015	.17372	.30148	.24007
Attractiveness of Market	.01308	.07630	.02863	.14085	.15090	.12547	.05248	.13625	.12599	.18993
<u>Subjective Factors</u>										
Save Money	.20296	.02964	.11952	.30732	.22942	.35834	.27315	.32269	.25785	.33743
Save Time	.21873	.47284	.40838	.13763	.19672	.18025	.16720	.10981	.35328	.17344
<u>Farmers' Characteristics</u>										
Income	.20504	.15754	.07422	.08169	.19723	.02791	.18233	.15227	.10135	.13169
Age	.23191	.22048	.10186	.08108	.05346	.02889	.09664	.00384	.17637	.10100
Education	.10334	.12690	.20494	.04804	.25733	.11485	.00893	.10576	.06412	.04632
Length of Residency	.21737	.17503	.09554	.06371	.22736	.24846	.14459	.03181	.29127	.15254
Shopping Trips Per Week	.13326	.02296	.05065	.02776	.14517	.13221	.01881	.02094	.16038	.00262
Farm Size	.03810	.00140	.22351	.01999	.16823	.02605	.22763	.16517	.23131	.07708
Farm Consolidation	.22070	.14748	.08545	.13743	.10911	.15592	.14698	.11741	.15076	.03194
Full- or Part-time Farming	.05263	.01957	.17396	.06637	.34851	.08212	.13023	.28264	.25607	.13697
Type of Farming (Cash crop, dairy, etc.)	.27503	.21224	.11965	.14534	.08601	.06587	.07434	.02647	.11726	.02306
Change to specialization	.09132	.07325	.04904	.00483	.02409	.03546	.09333	.10488	.01367	.00408
Time of farm automation	.04095	.06984	.18469	.02734	.15610	.31721	.06387	.02066	.22608	.20787

*Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables having only one degree of freedom.

SOURCE: Data is derived from Appendix C (Tables C.1-C.10)

TABLE 6.4.2: Factors Related to Nonfarm Families' Shopping Travel Models for Sampled Functions: Cramer's V and Phi-coefficient

Factors/Functions	Grocery Store	Opto-metrist	Clinic	Floor Covering Store	Jewelry Store	Paint & wallpaper Store	Department Store	Family Clothing STORE	Auto-motive Dealer	Shoe Store
<u>Objective Factors</u>	Cramer's V and Phi-coefficients*									
Distance	.56387	.51700	.50345	.05676	.06482	.09283	.01760	.03355	.38069	.17395
Price of Goods	.28151	.16896	.02373	.05190	.03976	.21817	.26162	.22479	.07358	.19285
Specialized Goods/ Services	.17314	.32535	.42607	.22616	.12109	.19167	.24250	.27962	.25044	.28813
Shopping Convenience	.12366	.15117	.19905	.08224	.00672	.11435	.12333	.22148	.10631	.21690
Attractiveness of market	.11866	.07564	.03087	.07443	.17094	.16116	.08627	.21272	.06984	.21272
<u>Subjective Factors</u>										
Save Money	.23428	.18157	.01475	.11888	.04085	.16386	.27292	.31277	.05151	.20420
Save Time	.16826	.27594	.18952	.15421	.10445	.09469	.11476	.08364	.14075	.21018
<u>Non-Farmers' Characteristics</u>										
Income	.08547	.20587	.19760	.17550	.01952	.15476	.06236	.11099	.29680	.11642
Age	.14360	.37817	.23685	.15811	.07024	.27477	.04486	.06618	.10057	.05087
Education	.18238	.10124	.03007	.22131	.13766	.04358	.10557	.15922	.09499	.09077
Length of Residency	.24962	.05578	.18099	.04242	.03902	.04545	.05415	.14215	.04603	.13290
Shopping Trips Per Week	.22197	.10025	.05340	.12123	.08986	.07944	.04340	.01160	.04194	.10148

*Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables having only one degree of freedom.

SOURCE: Data is derived from Appendix C (Tables C.11-C.20)

(Figures 6.2.3 and 6.2.4). There was a greater tendency toward grocery shopping in the local villages, rather than urban central places, among the rural families that had resided longer in their present location. The greatest percentage of outshopping of local grocery stores was done by rural families with short residency and nonfarm families considerably exceeded farm families in this regard.

Therefore, future increases of new rural nonfarm residents in the study area, will not be favorable for local grocery stores. The factor of age was also important in the farmers' grocery shopping. The older farmers were more likely to do their grocery shopping in a nearby central village, while younger farmers were more oriented toward urban central places for grocery shopping.

Type of farming was also significant in the grocery shopping behavior of farmers (Figure 6.2.3). More farmers who were producing crops, cash crops, and feed tended toward grocery shopping in central villages than dairy and beef farmers, which may be related to the convenience of local elevators for cash crop and feed crop farmers. When they visited the local elevator, they also tended to do their grocery shopping in that place. Prices of goods were a complementary significant factor in the nonfarm families' grocery shopping behavior (Figure 6.2.4). Because of grocery price considerations among some of the nonfarm families, there was a greater standard deviation in their

travel mileage for grocery shopping compared with farmers' grocery shopping patterns (Table 6.3). Rural nonfarm families thus outshopped the local grocery stores more than farm families, due to better prices available in urban central places.

The factor of income was also hypothesized to be influential in the individual shopping behavior of rural families. The relations between them were found to be between the .10 and .05 significance levels (Figure 6.2.3), with a strong Cramer's coefficient (Table 6.4.1) among the farm families' grocery shopping model. Although income was not as significant as other factors (such as distance, age, etc.) in the grocery shopping of farmers, it was influential. Of lower income families, 59 percent shopped the grocery in their central villages while 41 percent shopped in urban central places. Of higher income farmers, 56 percent shopped the grocery in the central village, while 44 percent shopped in urban central places. These percentages show that farmers of any income level are likely to do their grocery shopping in their nearby central village, but there is a tendency for outshopping for groceries among the higher income farmers. Income was not statistically significant for nonfarm families' grocery shopping (Figure 6.2.4), but there was also a tendency among higher income people for grocery outshopping.

Trips per week to a local town was hypothesized to be another factor influencing the grocery shopping of rural families. Although not a statistically significant factor in the grocery shopping model (Figure 6.2.3 and 6.2.4), there was some preference among the most mobile 25 percent of rural nonfarm families to patronize local grocery stores, while 38 percent of less mobile nonfarm families patronized local grocery stores. Therefore, more of the most mobile families did their grocery shopping in urban central places (outshopping). Of the farm families, 59 percent of the less mobile families and 60 percent of the more mobile families patronized local grocery stores. Overall, the factor of mobility had little affect on farm families' grocery shopping behavior.

It was found that the grocery store as a sixth order village function is unstable and seems likely, at this juncture, to become a fifth order village function in the future. This is due to the precipitous decline in the viability of sixth order villages to the hamlet level. Dissatisfaction with local rural goods and services available in sixth, fifth, and fourth order villages has existed, at least since 1950, among the rural families of the village hinterlands who demonstrated their lack of satisfaction with such local functions by bypassing them for urban central places. The major problem of these smaller rural settlements of study area was related to the limited

functions they offered. Thus, the fourth, fifth and sixth order villages were dispatronized by farm and particularly the nonfarm families to the benefit of urban central places in a process of rural development in the region that began around the 1950s. Price considerations in grocery shopping among the rural nonfarm population only encouraged their patronage of grocery stores in urban centers. It was found that the sixth order villages were very sensitive to the effects of rural development and the concomitant increase of the nonfarm population (urban patronizers) in the area (Chapter Five). Therefore, maintaining the lowest level functions, such as grocery stores, in the sixth order villages have faced the serious problem of being typical in sixth order villages. Further rural development, bringing more new nonfarm families into the study area, can be expected to result in even more bypassing of local grocery stores, eventually affecting fifth and fourth order villages in the same way sixth order villages have been affected. It is, therefore, not unrealistic to expect that in the future, the fourth and fifth order villages will become as nonviable as the present sixth order villages, due to rural development and rural families' shopping preferences.

Third Order Village Functions

The two non-retail functions of optometrist and clinic were available almost typically in first, second and third

order villages by 1980 (Table 6.2). In 1970 there were only two optometry establishments (functional units) in the study area's central villages (Table 5.9) that increased to nine establishments by 1980 (Table 6.2). They were typical only in first order villages in 1970 (Table A.7). The increase of optometrists was related to support of this function by both farm and nonfarm families (Table 6.3.1). Clinics were increased from one unit to eight units in the study area over the 1970-1980 period (Table 5.9). Clinics were a typical function in only the first order villages in 1970, but increased to become almost typical in second order villages and near typical in third order villages by 1980 (Tables 5.19 and 6.2). The increased number of local clinics is related to their use by a high percentage of both farm and nonfarm families (Table 6.3.1). The percentage of those invisiting the clinics was greater among farm families than nonfarm families.

Rural families' travel mileage for both the optometry and clinic functions had greater means and standard deviations than did the grocery store function (Table 6.3). Optometry and clinic can thus be called spatially flexible rural services, compared with the spatially inflexible function of grocery. As Golledge, Rushton and Clark (1966:263, 264) explain, a spatially flexible function is patronized by people who travel greater distances for that function instead of patronizing the nearest place, while spatially

inflexible goods are patronized by people who seek the nearest occurrence of those functions. The percentage of rural farm and nonfarm families visiting the local optometrists were very similar (Table 6.3.1) and the mileage travelled to visit the optometrists at the central places were quite high for both groups (Table 6.3 and Figures 6.3.1 and 6.3.2). On the whole, rural nonfarm families had a bigger range of travel and demonstrated a little less support for local optometrists compared with farm families.

Among the factors examined for modal choice of the optometrist function, distance, age, specialized goods and services, and time saving were statistically significant with strong coefficients of association among both the farm and nonfarm families surveyed (Figures 6.3.3 and 6.3.4 and Tables 6.4.1 and 6.4.2). Age was an influential factor in the choice of a local or distant optometrist. There was obvious patronization of local optometrists among elderly farm and nonfarm families, while middle-aged and younger ones tended to patronize optometrists in urban centers. This means that elderly residents were more satisfied with the local optometrists than younger and middle aged families. The factors of distance (objective) and saving time (subjective) were also important among farm and nonfarm families who patronized local optometrists. Perception of optometry as a specialized function was influential in

**Farmers' Visiting Travel:
Optometrist**
South-central Michigan, 1983

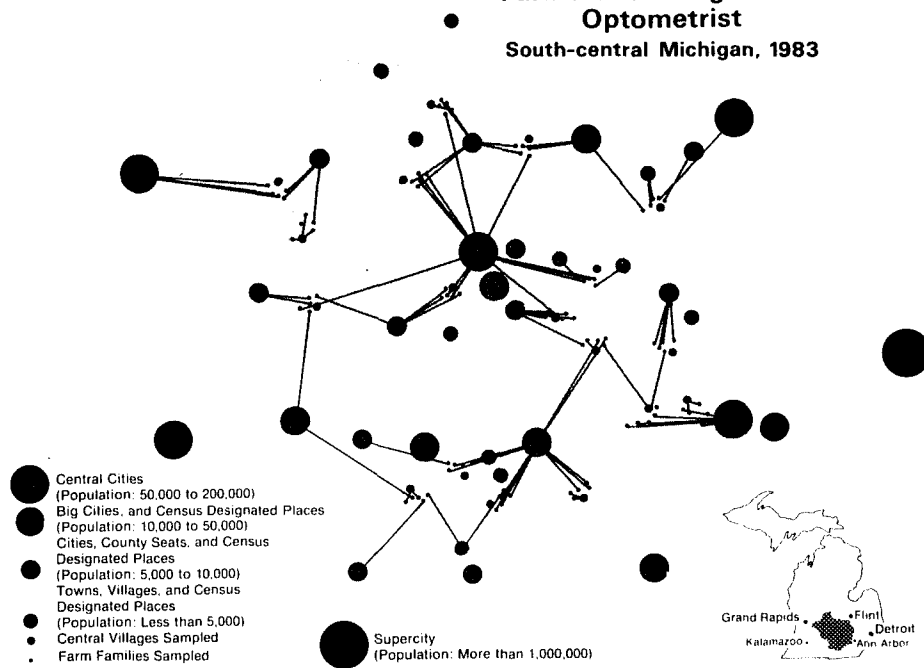


Figure 6.3.1 Visiting travel model of farm families
sampled for optometrist.

**Rural Non-Farm Families Visiting Travel:
Optometrist**
South-central Michigan, 1983

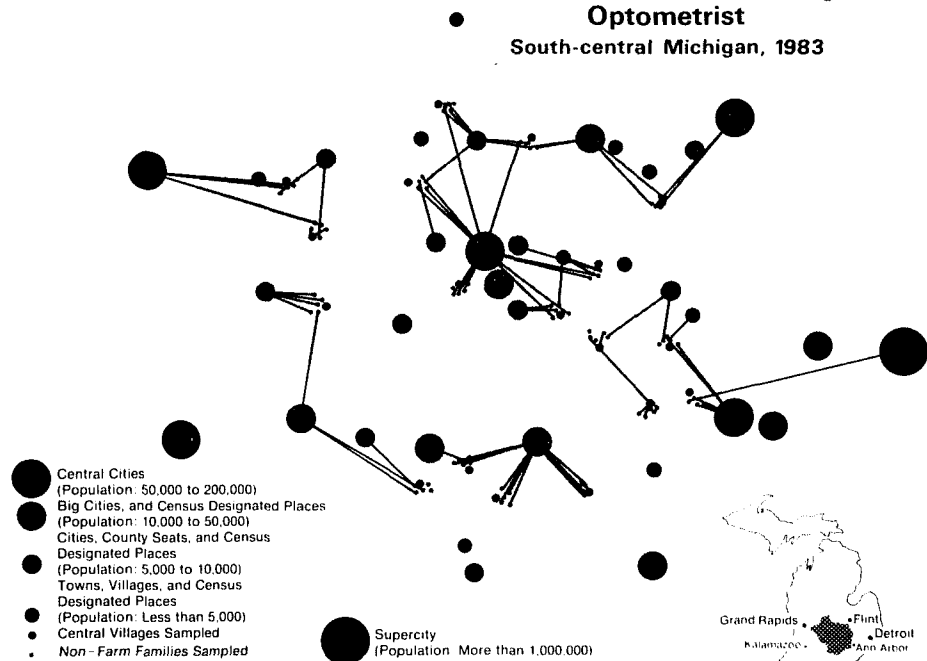


Figure 6.3.2 Visiting travel model of non-farm families
sampled for optometrist.

Factors Related to Farmers' Selection of Optometrists in Certain Central Places

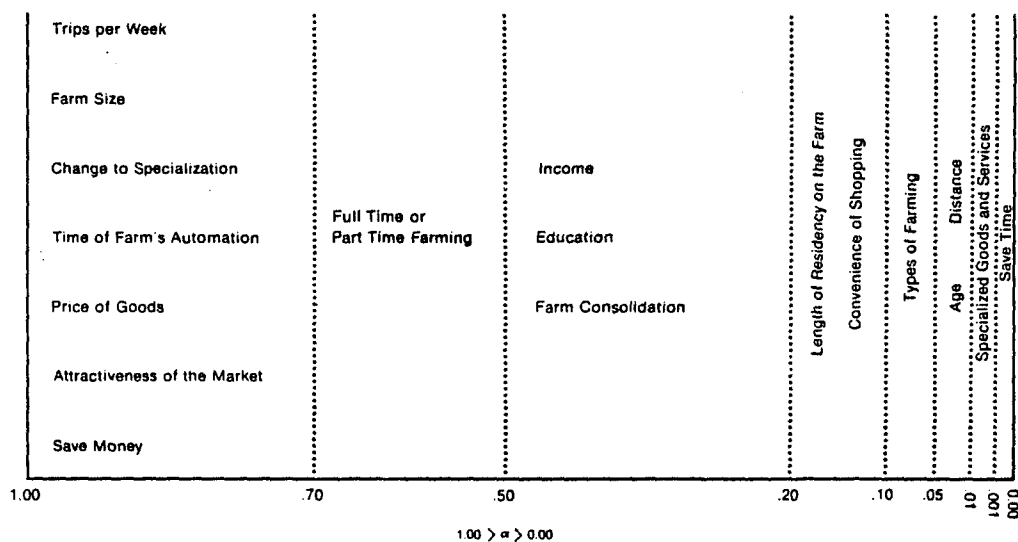


Figure 6.3.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of optometrists; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of optometrists.

Factors Related to Non-Farmers' Selection of Optometrists in Certain Central Places

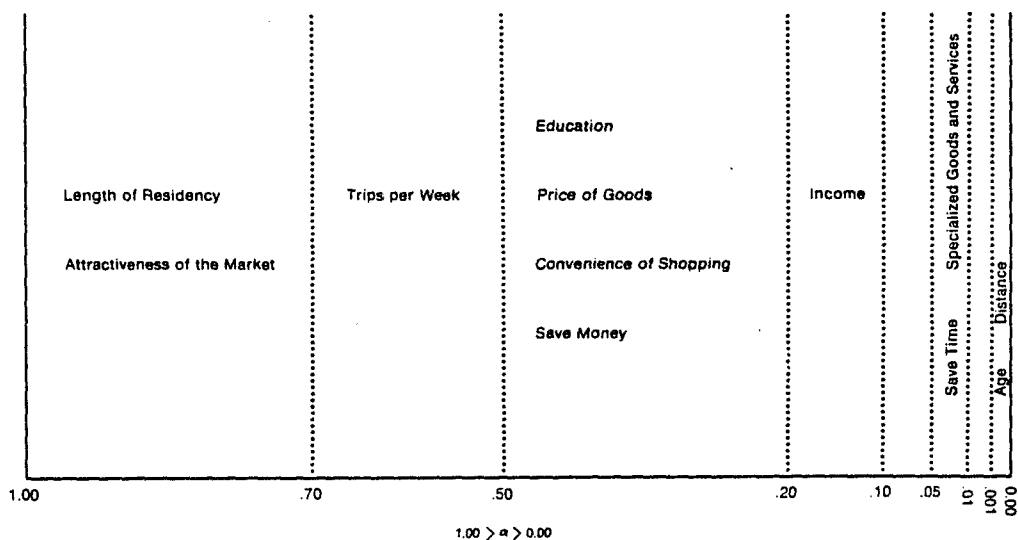


Figure 6.3.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of optometrists; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of optometrists.

encouraging farm and nonfarm families to bypass local optometrists.

Type of farming was statistically significant at the .05-.10 level (Figure 6.3.3) with a strong Phi-coefficient. There was greater support of local optometrists by general farmers who plant cash and field crops, compared with dairy or beef farmers. This may be related to more frequent visits to central villages by cash crop farmers who deal with local elevators. Therefore, they are tied more closely to the local rural services, including optometrist.

On the whole, optometry was found to be a function most often outvisited by rural families of various incomes, but there was a slight tendency for higher income farm and nonfarm families to favor local optometric services more than lower income farm and/or nonfarm families. It may be noted that the higher income rural families preferred to save time by patronizing a local optometrist (saving time was statistically significant among farm and nonfarm families). There was no significant association, however, between farm and nonfarm families' shopping trips per week and their choice of a local or distant optometrist (Figures 6.3.3 and 6.3.4), indicating that degree of mobility among rural families is not important in their locational choice of an optometrist.

Optometrists, as a flexible function, are in competition with urban central places' optometrists, which could be

harmful for their future survival at the level of third order villages. On the other hand, with increased nonfarm population on the farm landscape of the study area, local optometrists may remain stable at their present level.

As mentioned earlier, local clinics were supported by both farm and nonfarm families at a high percentage level compared with other sampled functions except grocery (Table 6.3.1). The mileage travelled and related means and standard deviations for clinic visits were greater among nonfarm families than farm families (Table 6.3 and Figures 6.4.1 and 6.4.2). On the other hand, standard deviations for the mileage travelled by farmers for clinic visits was moderate. Variations in mileage travelled and standard deviations between these farm and nonfarm groups indicate that clinic is a flexible function. With the local support of both farm and nonfarm families, local clinics may survive locally, in spite of their competition with urban clinics. However, large increases of nonfarm families, who had a great range for clinic visits, could cast doubt on the stability of local clinics.

Highly significant factors that influenced the farm and nonfarm families' choice of clinics in a central place were distance (proximity) and perception of the clinic as a specialized service, which yielded strong coefficients of association shown by Phi-coefficients and Cramer's statistics

(Figures 6.4.3 and 6.4.4 and Tables 6.4.1 and 6.4.2) Time-saving and convenience were statistically significant aspects of farm families' clinic visits, in that some of them visited a nearby clinic for convenience. Time-saving and convenience were highly significant for nonfarmers at an 80-90 percent of probability of association (Figure 6.4.4). The significance of proximity (distance) to a local clinic, and time-saving and convenience aspects were factors that encouraged rural families to visit local clinics. Perceptions of clinics as specialized services, however, encouraged rural families' visitations to urban clinics. A future increase of specialized clinics in urban centers, could cause a decline in local clinics.

Level of education was an important factor among the farm families. There was a tendency for less educated farmers to visit the clinics in central villages rather than those in urban central places. Length of residency and age were significant factors influencing nonfarmers' clinic visiting patterns (Figure 6.4.4). The younger nonfarm families with fewer years of rural residency were more likely to visit the local clinics than middle-aged and elderly nonfarm families with more years of residency. Middle-aged, nonfarm families had more local clinic visits than elderly nonfarmers. The decreased patronization of local clinics by elderly nonfarm families may be related to their needs for more specialized professional help available in urban clinics and hospitals. The support of local

**Farmers' Visiting Travel:
Clinic
South-central Michigan, 1983**

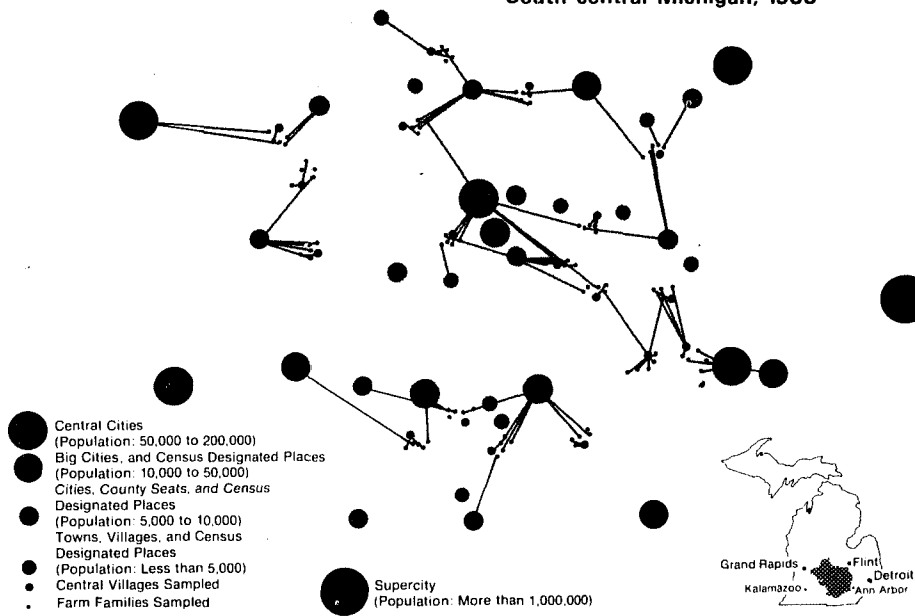


Figure 6.4.1 Visiting travel model of farm families sampled for clinic.

**Rural Non-Farm Families Visiting Travel:
Clinic
South-central Michigan, 1983**

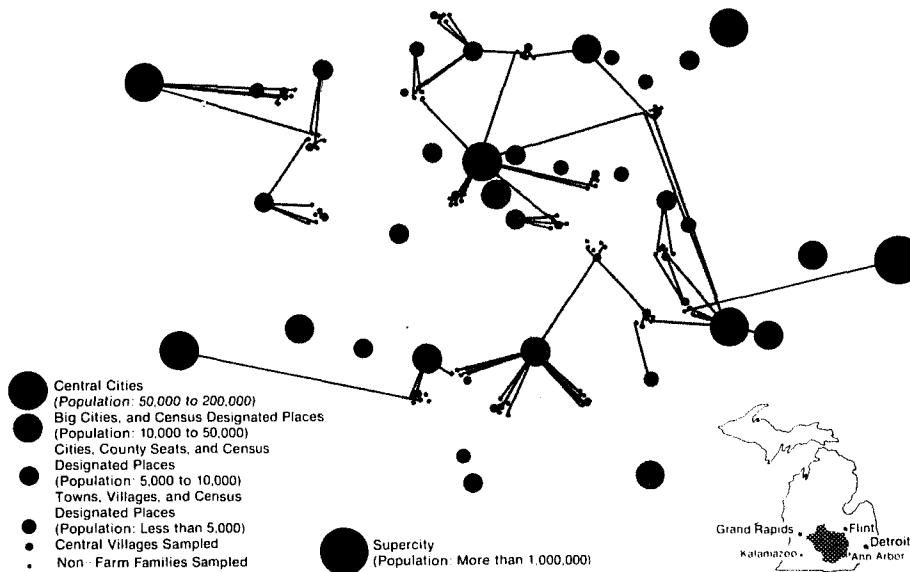


Figure 6.4.2 Visiting travel model of non-farm families sampled for clinic.

Factors Related to Farmers' Selection of Clinics in Certain Central Places

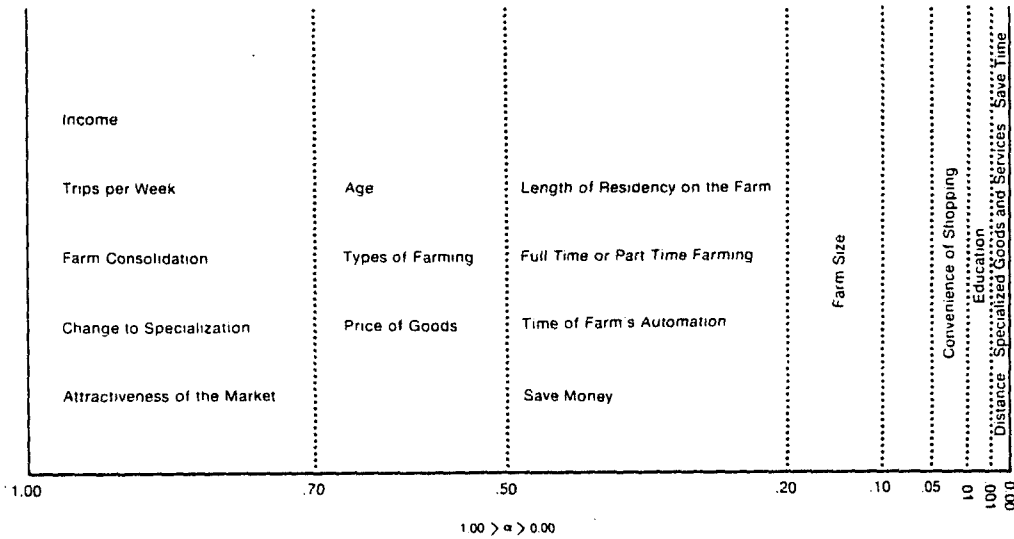


Figure 6.4.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of clinics, and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of clinics.

Factors Related to Non-Farmers' Selection of Clinics in Certain Central Places

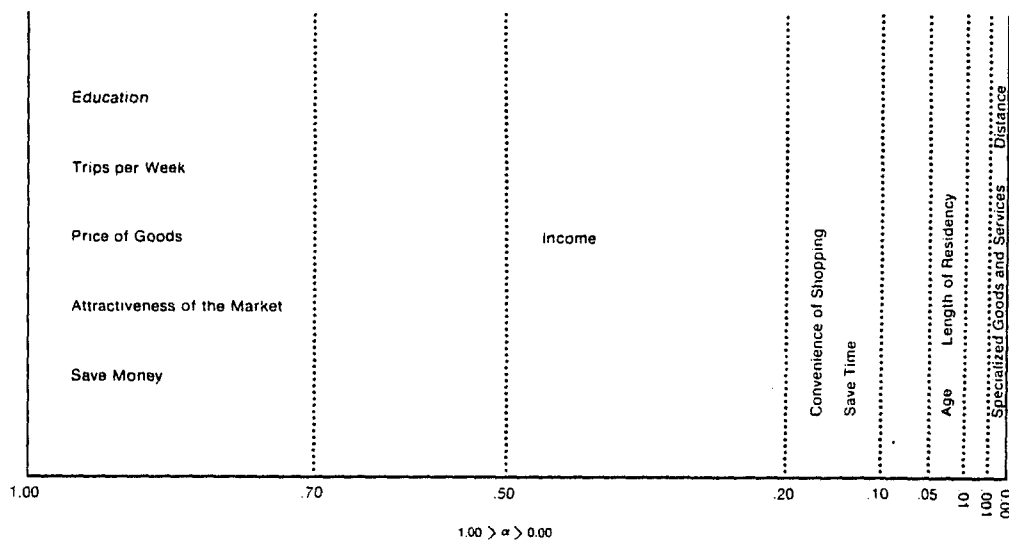


Figure 6.4.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of clinics, and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of clinics.

clinics by the young, nonfarm families reveals their satisfaction with these local health centers. The factor of age was not statistically significant in the clinic visiting patterns of farm families. In fact, there were almost the same percentages of young, middle-aged and elderly farmers who patronized the local clinics with a slight preference in favor of the elderly and the young farmers. Future increases in young rural, nonfarm families in the central villages and their environs would be encouraging for some of the local clinics.

The factors of income and mobility were not found to be statistically significant in the clinic visiting models of farm and nonfarm families. This means that patronization or dispatronization of local clinics is unrelated to income level or degree of mobility of rural families. Other factors discussed earlier (such as distance, specialization, and convenience) were more statistically influential in clinic visiting models than levels of income and mobility.

As a conclusion, the importance of proximity to a local clinic, convenience and time-saving considerations among the rural farm and nonfarm families, may be supportive for retention of the local clinics at the level of third order villages. However, because there is a large difference in the standard deviations of clinic travel for nonfarm and farm families, any future increase of nonfarm population could jeopardize the existence of many local clinics. Thus,

clinics may eventually be ranked at the level of second order villages where they may be more viable than in third order villages.

Second Order Village Functions

Floor covering stores and jewelry stores were found to be typical retail functions of first and second order villages. A single floor covering store first appeared as a nontypical function in the villages studied in 1970, but by 1980 there were six such stores, making this relatively new function a typical function in first and second order villages (Tables 5.7 and 5.12). In contrast, jewelry stores were a declining retail function in the study area. They were typical in first, second, and third order villages in 1950 and were still typical in those villages but at a reduced average number of stores by 1970 (Table 5.10). Continuing reductions in jewelry stores over the next decade did not affect their role in first and second order villages but made them atypical in third order villages by 1980 (Table 5.10). Thus, jewelry stores declined and floor covering stores increased to the point that both became typical functions of first and second order villages in 1980 (Table 6.2).

Floor covering stores with a relatively high mean and standard deviation for mileage travelled by farm and nonfarm families (Table 6.3) and with a low percentage of local

inshopping (8.6 percent) by farm and nonfarm families (Table 6.3.1), is clearly a spatially flexible function. A greater range of mileage was travelled by nonfarm families than farm families in shopping for floor coverings (Figures 6.5.1, 6.5.2, and Table 6.3). There was also a lower percentage of local inshopping (5.5 percent) for floor coverings attributed to nonfarm families (Table 6.3.1). However, farm families were a little more supportive of the local floor covering stores. In spite of their growth in the study area, the inshopping percentage for farm families was also low. Thus, the retention of this function at the level of second order villages might be shakey. It seems likely they will be maintained only at the level of first order villages in the future.

Among the factors influencing the floor covering shopping of rural families, saving money was statistically significant for farm families, but not significant for nonfarm families (Figures 6.5.3 and 6.5.4 and Tables 6.4.1 and 6.4.2). The money saving consideration caused more outshopping among farm families who tended to shop for sales. While money saving was not statistically significant for nonfarm families, there was a greater tendency for outshopping among nonfarm families who looked for sales of floor coverings in urban central places.

Educational level was statistically significant for nonfarm families (Figures 6.5.3 and 6.5.4 and Tables 6.4.1

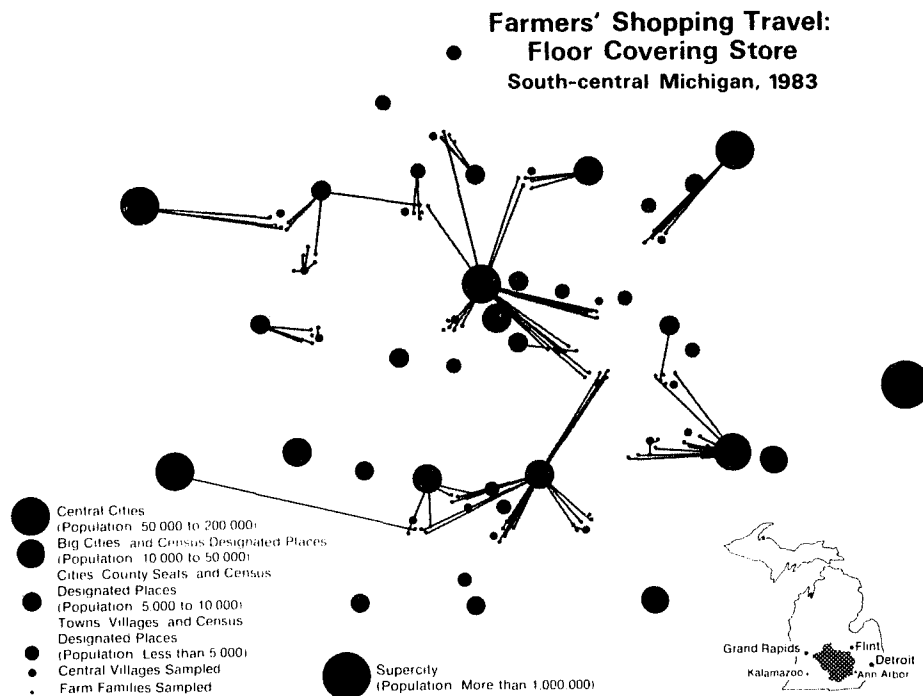


Figure 6.5.1 Shopping travel model of farm families sampled for floor covering store.

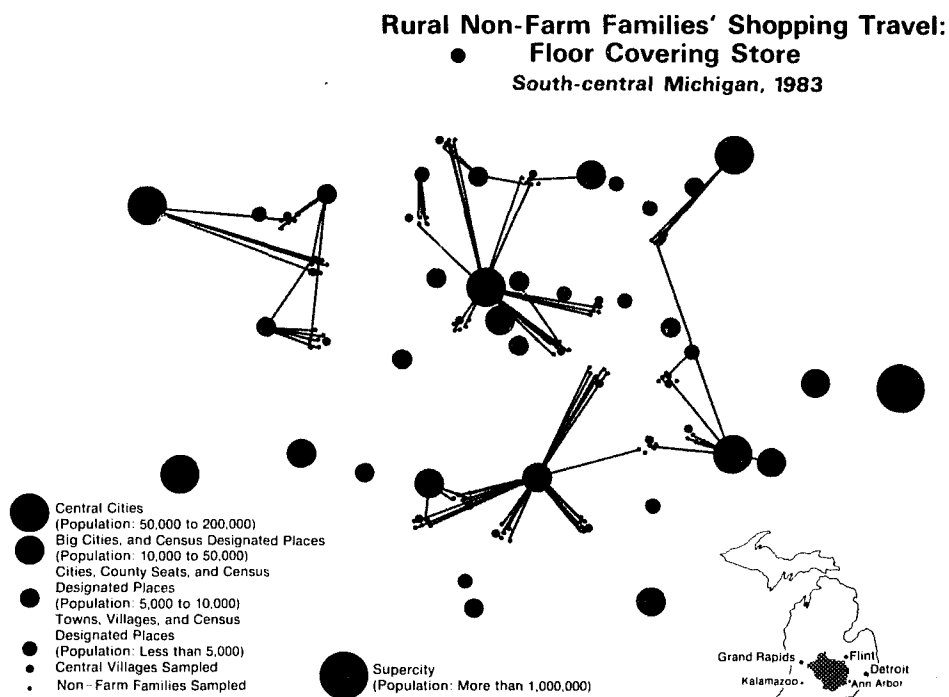


Figure 6.5.2 Shopping travel model of non-farm families sampled for floor covering store.

Factors Related to Farmers' Selection of Floor Covering Stores in Certain Central Places

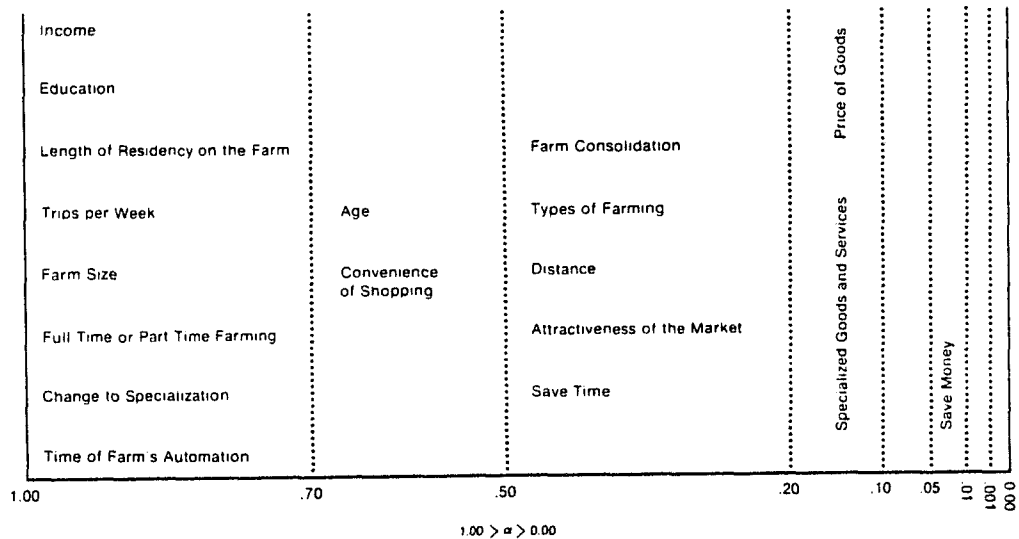


Figure 6.5.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of floor covering stores, and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of floor covering stores.

Factors Related to Non-Farmers' Selection of Floor Covering Stores in Certain Central Places

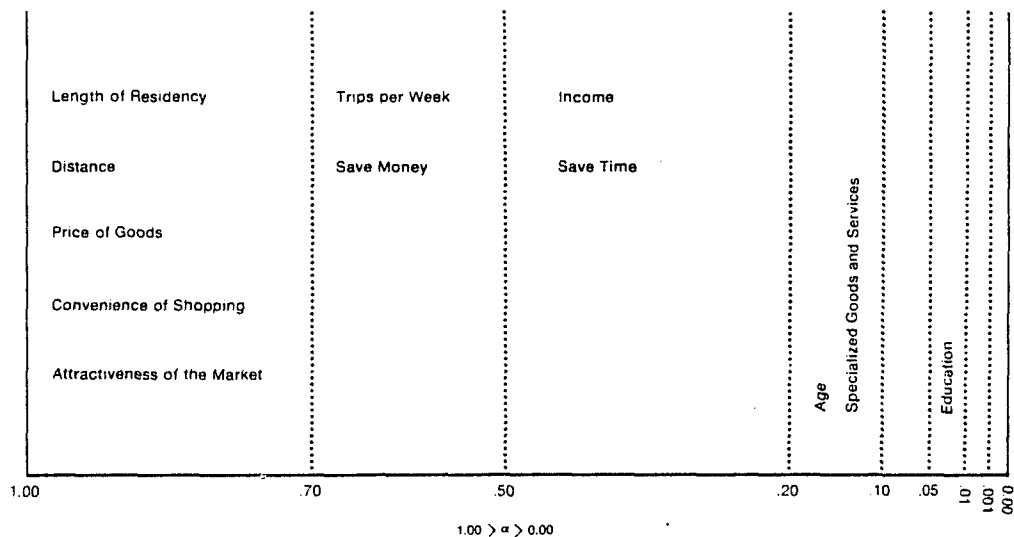


Figure 6.5.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of floor covering stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of floor covering stores.

and 6.4.2). It was found that more educated nonfarm families outshopped for floor covering. Education was not a statistically significant factor of store selection for farmers, but there was a preference for outshopping among more highly educated farm families. Identification of the floor covering store as a specialized function was classified in the .20-.10 column of probability of association for both farm and nonfarm families with fairly strong phi-coefficients (Figures 6.5.3 and 6.5.4 and Tables 6.4.1 and 6.4.2). This identification was influential in encouraging outshopping for floor covering among some of the rural farm and nonfarm families.

The income level of farm and nonfarm families was not statistically significant in their choices of a floor covering store (Figures 6.6.3 and 6.6.4), but there was a greater preference for outshopping among higher income families that was stronger in the case of nonfarm families. There was no statistically significant association between the frequency of trips and store choice of farm and non-farm families due to the great amount of outshopping among less mobile and more mobile people. But there was slightly more patronization of local stores by less mobile rural families.

The future of floor covering stores may continue to be stable in first order and second order villages, but the strength of the trend among rural families for outshopping this function is more likely to lead to a decline in such

stores particularly, in second order villages. The considerable range of the floor covering shopping model for nonfarmers, implies that future growth of the nonfarm population will be discouraging for local floor covering stores.

Jewelry stores, as another second order village function, had mean and standard deviations of farm families' shopping travel mileage that were similar to the shopping models for floor covering stores (Table 6.3). For nonfarm families, jewelry shopping travel was much shorter than for floor coverings. Meantime, the means and standard deviations of shopping mileage travelled for jewelry stores, was similar among both farm and nonfarm families (Table 6.3). The percentage of local jewelry inshopping was 9.5 percent for farm families, and 6.25 percent for nonfarm families which implied slightly more patronage of local jewelers among farmers than nonfarmers, but over 90 percent outshopping by both groups. Figures 6.6.1 and 6.6.2 show the jewelry shopping patterns of rural families and indicate the extent to which village jewelers are being outshopped to the benefit of jewelers in urban central places. These observations clearly show the jewelry store to be a spatially flexible function.

Chi-square tests showed that education and length of residency were statistically significant in the jewelry shopping behavior of farm families, but there were no

**Farmers' Shopping Travel:
Jewelry Store**
South-central Michigan, 1983

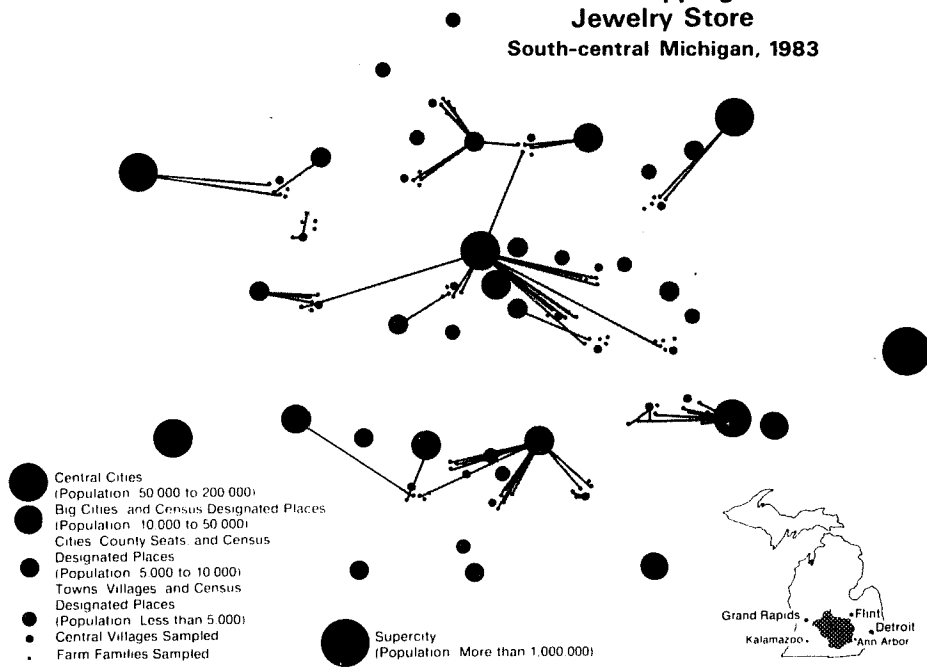


Figure 6.6.1 Shopping travel model of farm families
sampled for jewelry store.

**Rural Non-Farm Families' Shopping Travel:
Jewelry Store**
South-central Michigan, 1983

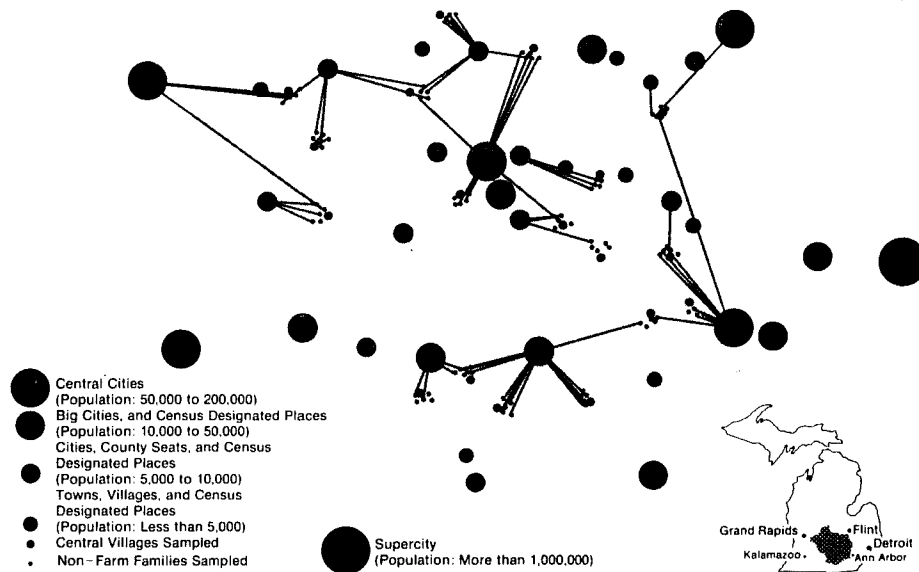


Figure 6.6.2 Shopping travel model of non-farm families
sampled for jewelry store.

significant factors to explain the jewelry shopping preferences of rural nonfarm families (Figures 6.6.3 and 6.6.4). A great amount of jewelry outshopping was done by rural nonfarm families who found urban centers more attractive than local markets. The factors of "attractiveness of market" and education level, which were those most closely associated with jewelry shopping among nonfarm families, were sorted at the significance level of .50 - .20 with stronger coefficients of strength than other factors (Figure 6.6.4). In fact, there was a 50-80 percent probability of association between these factors and the selection of a central place offering a jewelry store. While this was not statistically significant, it showed a tendency toward more outshopping by highly educated nonfarm families than less educated ones. Among farm families, also, the more educated families were more likely to outshop the local jewelry stores.

On the factor of residency, farm families with more years of local residency were more likely to patronize the local jewelry stores in the central villages than farmers with fewer years of local residency. It can be concluded, therefore, that more years of residency and less education among farm families favored local jewelry shopping (inshopping). Moreover, full-time farmers showed some tendency for jewelry inshopping, while part-time farmers almost always outshopped the local jewelry stores. For farm

Factors Related to Farmers' Selection of Jewelry Stores in Certain Central Places

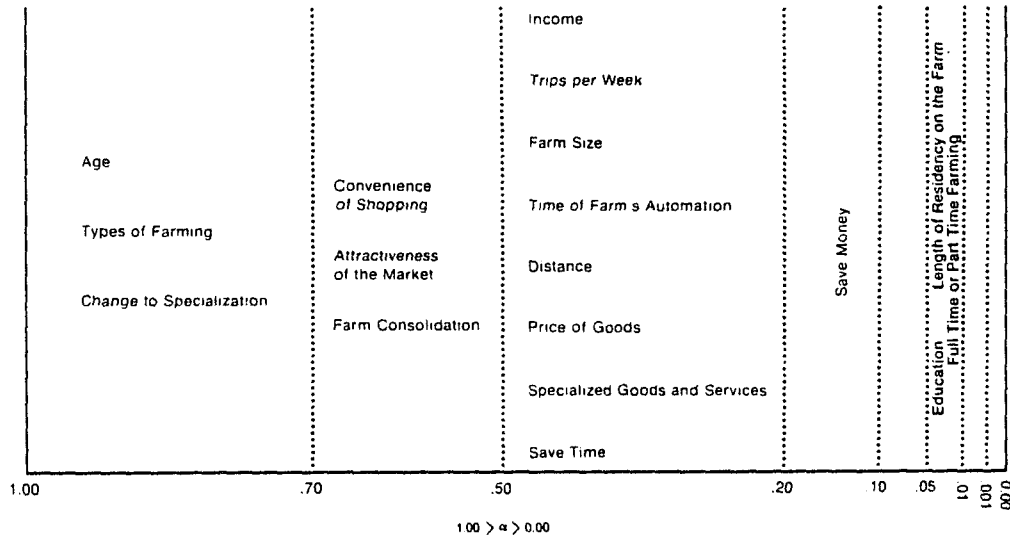


Figure 6.6.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of jewelry stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of jewelry stores.

Factors Related to Non-Farmers' Selection of Jewelry Stores in Certain Central Places

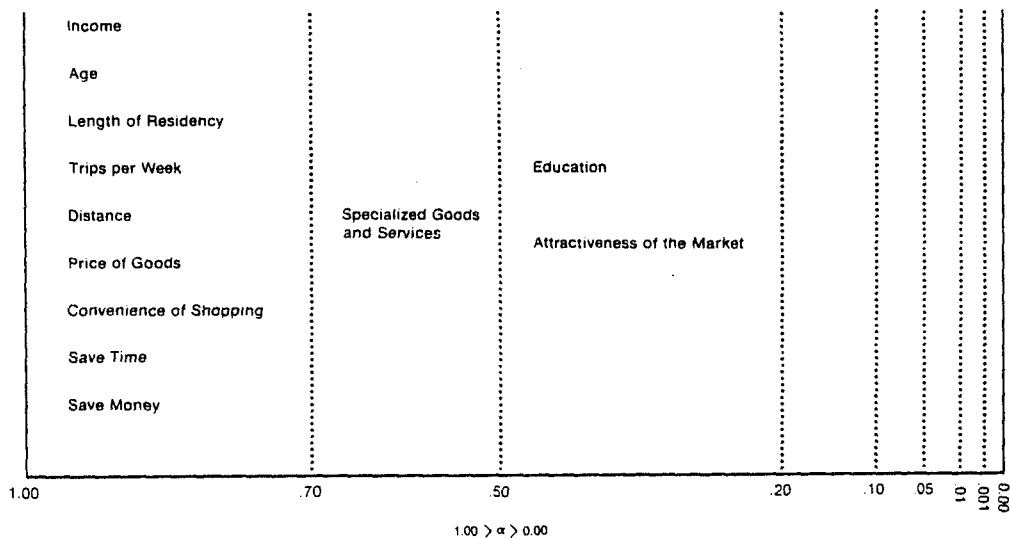


Figure 6.6.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of jewelry stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of jewelry stores.

families this was a statistically significant factor. As long as the part-time farmers and nonfarm residents continue to increase on the rural landscape of the study area, local jewelry stores can be expected to decline.

Income levels were not a statistically significant factor in the jewelry shopping patterns of rural families (Figures 6.6.3 and 6.6.4), but there was a tendency showing that higher income families were more likely to patronize the jewelry stores of urban centers and avoid the local ones. The frequency of trips was also not statistically significant in the jewelry shopping patterns of rural families. As a fairly durable, non-consumable item, jewelry shopping is occasional shopping and unrelated to the mobility of rural families.

As for the future prospects for local jewelry stores, it is likely they will be reduced in numbers as happened in the past and may remain a typical function only in first order villages. Significant outshopping for jewelry among rural families, and particularly the nonfarm families, has reduced the incidence of this central function in the shopping centers of local villages.

Dissatisfaction with local functions among rural residents of second order villages in the study area, was found to be a trend that was particularly evident in the mid-1970s. The trend was due, in large part, to the continuous decline of farm families and an increase in nonfarm families (who

are more city-oriented in their shopping). Continuation of the tendency will favor further decline in the functions of second order villages such as floor covering and jewelry stores. Retention of these functions, however, is more likely in the first order villages because of the stronger viability of first order villages.

First Order Village Functions

Among the sampled functions, paint and wallpaper stores and department stores were found to be typical functions of first order villages in 1980 (Table 6.2). Generally, they are functions that have not been typical or even near-typical of lower order villages. The paint and wallpaper store was characterized by high means and standard deviations in the mileage travelled by farm and nonfarm families (Table 6.3). The higher means and standard deviations in mileage travelled was observed among the rural nonfarm families (Table 6.3) who tended to patronize paint and wallpaper outlets in urban central places more than the farm families (Table 6.3.1). However, both farm and nonfarm families reported larger ranges of shopping travel for this function (Figures 6.7.1 and 6.7.2), which served to identify its status as a spatially flexible function. With any further increase of nonfarm population in the rural landscape of the study area, this function could become more flexible and in greater competition with urban central places.

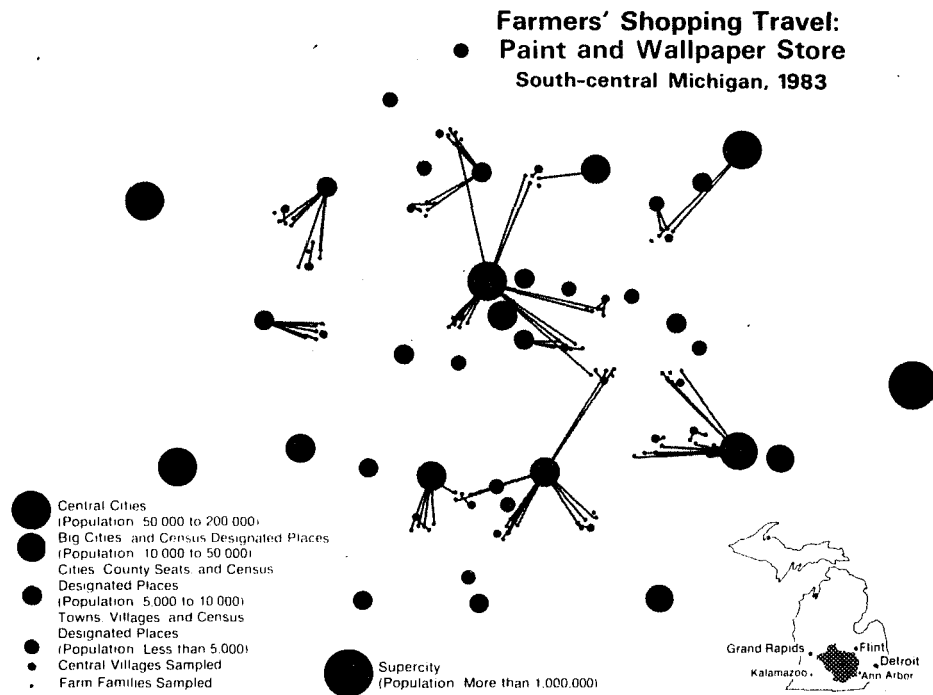


Figure 6.7.1 Shopping travel model of farm families sampled for paint and wall paper store.

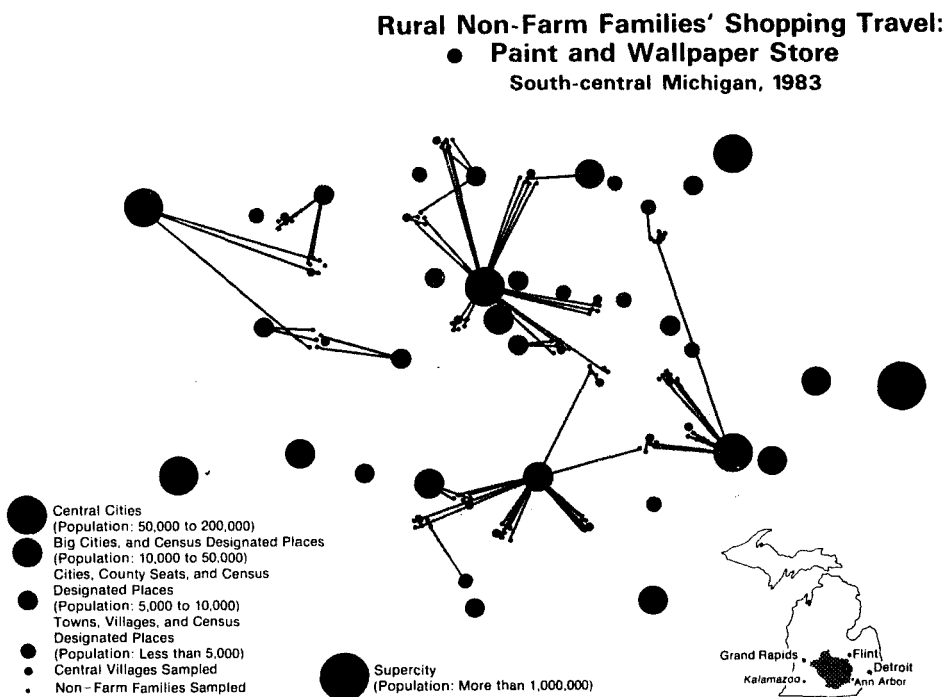


Figure 6.7.2 Shopping travel model of non-farm families sampled for paint and wallpaper store.

Of the factors that were influential in farm and nonfarm families' shopping models for paint and wall-paper stores, price had an 80 to 90 percent probability of association with a fairly strong coefficient of association (Figures 6.7.3 and 6.7.4 and Tables 6.4.1 and 6.4.2). The rural consumers' price considerations were found to be related to higher order functions that are typical in first order central villages. Farmers and nonfarmers reported that price considerations favored bypassing local paint and wallpaper stores to the benefit of urban central places. Saving money was a statistically significant factor for farm families, but less important to nonfarm families, with a probability of association between 70 and 80 percent (Figures 6.7.3 and 6.7.4). Both farm and nonfarm families that wanted to save money in shopping for paint and wallpapers, patronized urban central places rather than shopping at local villages. Taken together, results obtained for these two factors show that events which increase prices and/or increase concern for saving money among rural families can be harmful for local functions, especially first order functions like paint and wallpaper because rural families will increasingly bypass village establishments to save money through the price advantages they perceive to be available in urban central places.

Other statistically significant factors for farm families were length of residency and length of automated

Factors Related to Farmers' Selection of Paint and Wallpaper Stores in Certain Central Places

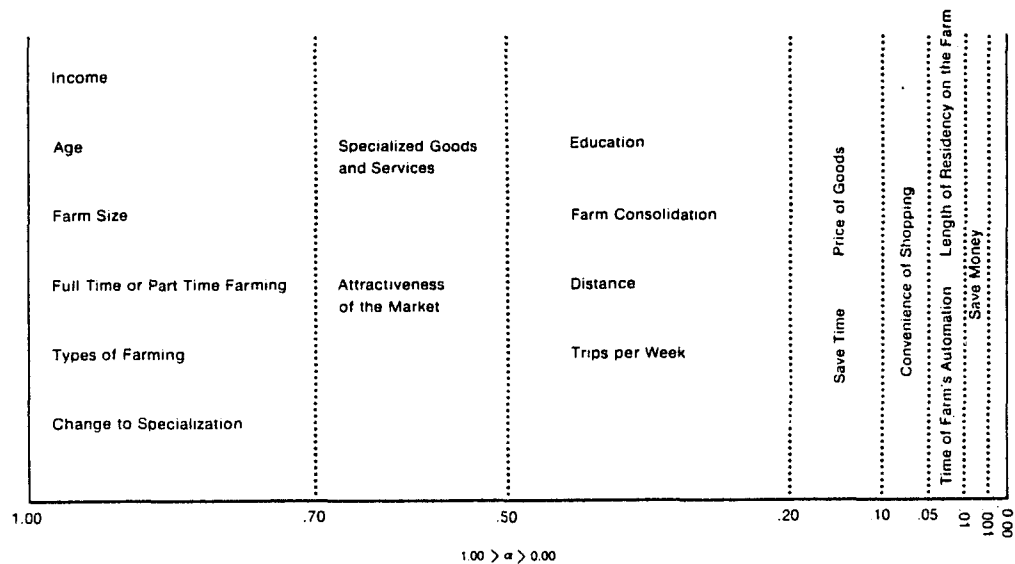


Figure 6.7.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of paint and wallpaper stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of paint and wallpaper stores.

Factors Related to Non-Farmers' Selection of Paint and Wallpaper Stores in Certain Central Places

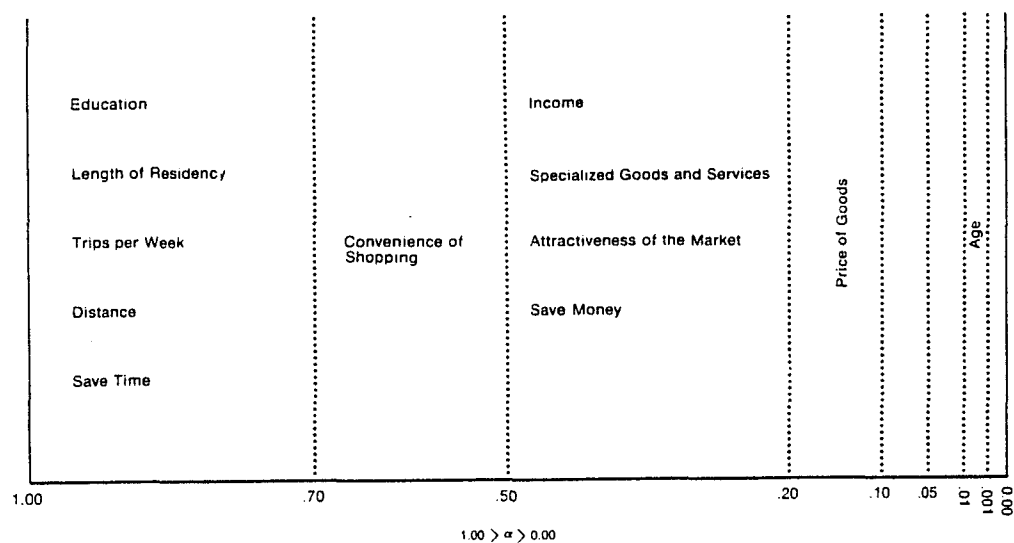


Figure 6.7.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of paint and wallpaper stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of paint and wallpaper stores.

farming. The date of farm automation was earlier among farm families who had resided longer in the study area. The farmers with shorter residency and consequently fewer years of farm operation, had also automated later and had fewer years of automated farming. Therefore, the two factors of length of residency and time spent in automated farming were sorted into the same class of significance on the tables of probability scales (Figures 6.7.3 and 6.7.4). There was a good percentage of farmers with longer residency, who had opted for earlier farm automation, who patronized the local paint and wallpaper stores of central villages (inshopping). On the other hand, the factor of age was found to be statistically significant among rural nonfarm families. There was a greater trend to inshopping by rural, nonfarm, elderly persons.

The factor of income level was not statistically significant in the farm families' shopping model for paint and wallpaper and outshopping was high at all income levels. For nonfarm families, however, there was a 50-80 percent probability of association between income levels and shopping models (Figure 6.7.4), with slightly more patronization of local paint and wallpaper stores among nonfarmers at higher income levels. On the whole, though, outshopping was so prevalent among the majority of nonfarmers of different income levels and most farmers, that the factor of income was essentially non significant.

The factor of shopping trips per week was found not to be statistically significant among farm or nonfarm families. Outshopping the local paint and wallpaper stores was very prevalent at all levels of mobility. However, local dissatisfaction and consideration of paint and wallpaper selection, quality and price were reported to be the most important reasons for outshopping by the rural families studied.

Because paint and wallpaper is a flexible and competitive function, its retention in central villages will be dependent on farm and nonfarm families' future preferences in relation to regional development.

Department store is another typical function at the level of first order villages. This high order function was typical in first order and second order villages in 1950 and remained typical in first order villages in 1970 and 1980 (Table 4.8). The average range of miles travelled by farm and nonfarm families to shop the department stores was high among both groups, compared with other sampled functions (Table 6.3). Observed standard deviations were also high among farm and nonfarm families. The greater standard deviation was observed for nonfarm families who outshopped local department stores in greater percentages than farm families (Table 6.3.1), but patterns of department store shopping for both farm and nonfarm families illustrate their strong preferences for patronizing the urban central places

in the study area (Figures 6.8.1 and 6.8.2). Department stores in rural villages are, thus, very flexible and sensitive to competition from urban center department stores. Since nonfarm families had greater dispatronization of local department stores, an increase of nonfarm families will tend to encourage more outshopping.

Due to local department stores' competitive disadvantages, they are outshopped by rural farm and nonfarm families for price considerations in their efforts to save money. These two factors were statistically significant with high strength coefficients in shopping models for department stores (Figures 6.8.3 and 6.8.4). The dissatisfaction of farm and nonfarm families with local department stores that generally offer fewer items, of lesser quality, at higher prices, has caused their dispatronization by local shoppers. The larger department stores of the study area's urban central places with their advantages of volume buying and ability to supply consumers with better quality goods at lower prices have proved more satisfaction to most of the area's rural families.

The convenience aspect was also statistically significant for farm families (Figure 6.8.3); it had 50-80 percent probability of association as an influential factor on nonfarm families' shopping travel for department stores (Figure 6.8.4). There is more local patronage by farm families who value the convenience of local department stores. Nonfarm

**Farmers' Shopping Travel:
Department Store**
South-central Michigan, 1983

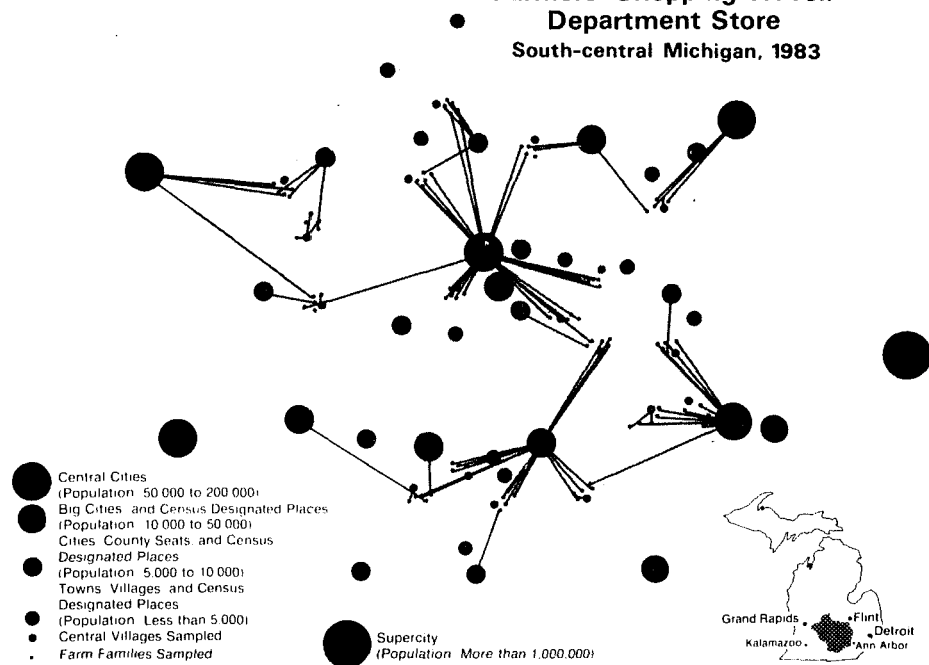


Figure 6.8.1 Shopping travel model of farm families
sampled for department store.

**Rural Non-Farm Families' Shopping Travel:
Department Store**
South-central Michigan, 1983

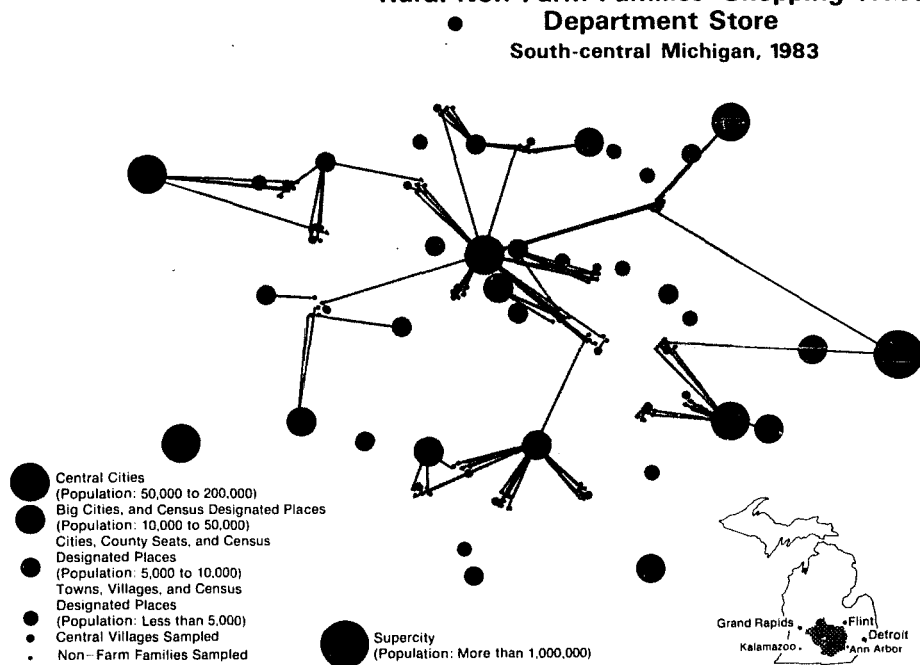


Figure 6.8.2 Shopping travel model of non-farm families
sampled for department store.

Factors Related to Farmers' Selection of Department Stores in Certain Central Places

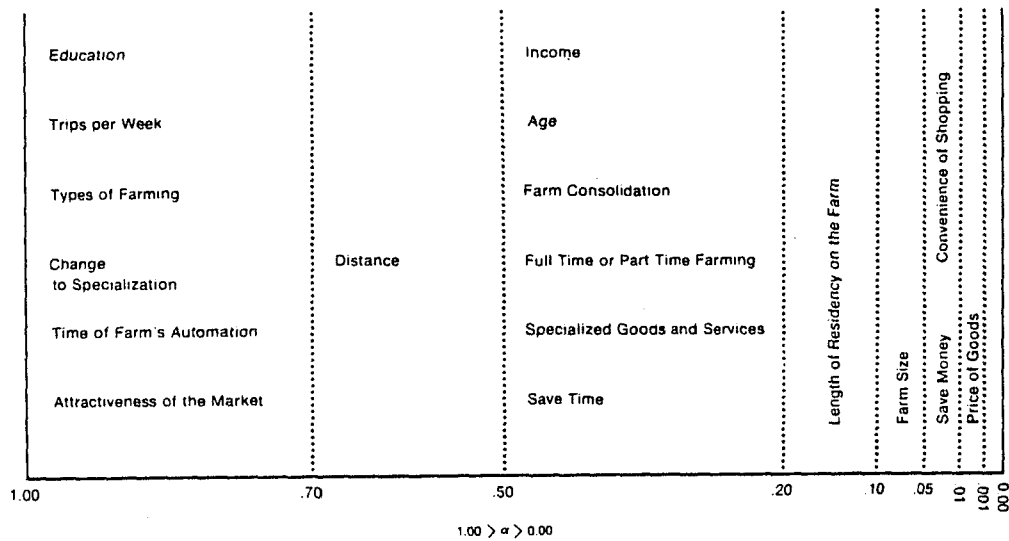


Figure 6.8.3 Chi-Square probability scale. Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of department stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of department stores.

Factors Related to Non-Farmers' Selection of Department Stores in Certain Central Places

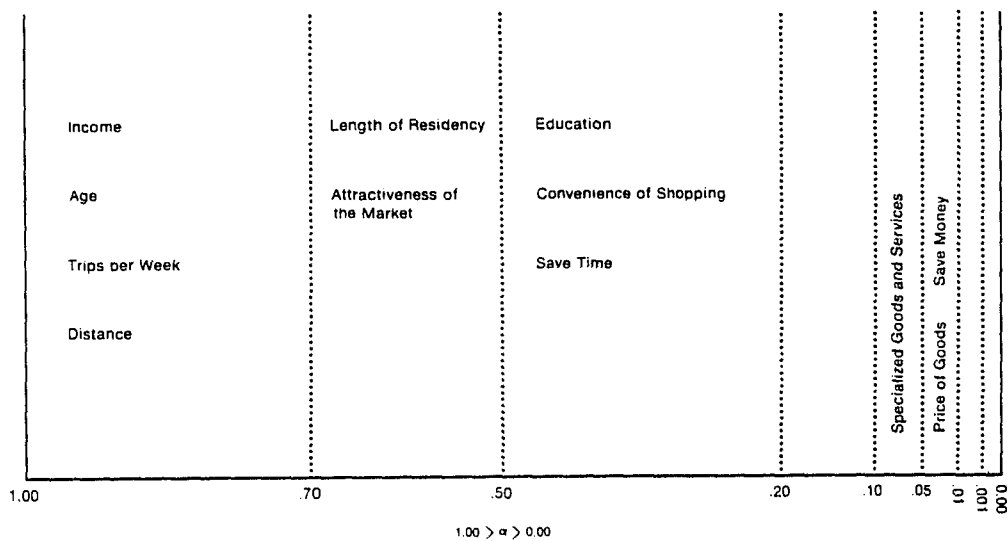


Figure 6.8.4 Chi-Square probability scale. Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of department stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of department stores.

families' convenience concerns are directed mostly toward the selection of department stores in urban central places.

The factor of income was not statistically significant in rural farm and nonfarm families' shopping model for department stores (Figures 6.8.3 and 6.8.4), but there was some tendency toward outshopping by higher income farm and nonfarm families. In frequency of shopping per week, neither statistical significance nor any tendencies were evident. Therefore, income level had little influence on shopping models for department stores, while differences of mobility among rural families had no effect on outshopping or inshopping.

In conclusion, rural families' preference for shopping at urban department stores with greater selection and better prices, was more influential than other factors such as income and mobility. Local department stores, as a first order village function, may remain at the level of first order villages in the coming years, but this will depend on the extent of any further declines in farms and farm families and future increases of nonfarm families in the study area.

The first order villages with their relatively strong viability among the classes of central villages have had smaller losses in their retail functions over the study time (Chapter Five). However, due to the increase of rural non-farm families who prefer shopping in urban central places,

first order village functions including paint and wallpaper stores and department stores, may become atypical to first order villages and be ranked as town and city level functions.

Town and City Level Functions

The functions of family clothing, automotive dealers, and shoe stores evidenced considerable instability as typical functions of particular classes of central villages over the study time. There was also considerable evidence that rural families preferred to patronize urban area establishments for these functions. Although sometimes appearing in rural villages, these functions were stable only at town and city levels. Due to the peculiarities of each function, they are discussed separately here.

The family clothing store function increased in frequency of functional units in the central villages studied (Table 5.7), but its existence as a typical function in different classes of central villages was very unstable over the study time (Table 4.8). For instance, in 1950 it was near typical only in the third order villages, it was near typical only in the second order villages in 1970 and had become typical in third and fourth order villages by 1980 (Table 4.8). This implies that the present family clothing stores in lower order villages have a somewhat shaky viability that does not bode well for their continued existence

in those villages, particularly because this function is very competitive.

The average range of farm and nonfarm families' shopping travel for family clothing store was high compared with other sampled functions (Table 6.3 and Figures 6.9.1 and 6.9.2). The very small percentage of inshopping (5.9 percent for farmers, 2.3 percent for nonfarm families) for family clothing implied that this function was highly flexible and was a town or city level function due to the considerable willingness of rural families' preference to travel to urban central places to shop for family clothing (Table 6.3.1). The greater standard deviation for nonfarm families compared with farm families (Table 6.3) indicates that nonfarmers outshop the local family clothing stores more than the farm families by 97.7 percent to 94.1 percent, respectively (Table 6.3.1). With future increases in the nonfarm population of the study area's rural landscape, elimination of local family clothing stores is probably unavoidable.

The rural farm and nonfarm families' concerns about prices and saving money were influential in their patronage of urban central places' family clothing stores. Saving money was found to be statistically significant among both farm and nonfarm families (Figures 6.9.3 and 6.9.4). The factor of price was statistically significant for the farm families' shopping model of family clothing stores (Figure 6.9.3), but it was less statistically significant with 80

**Farmers' Shopping Travel:
Family Clothing Store**
South-central Michigan, 1983

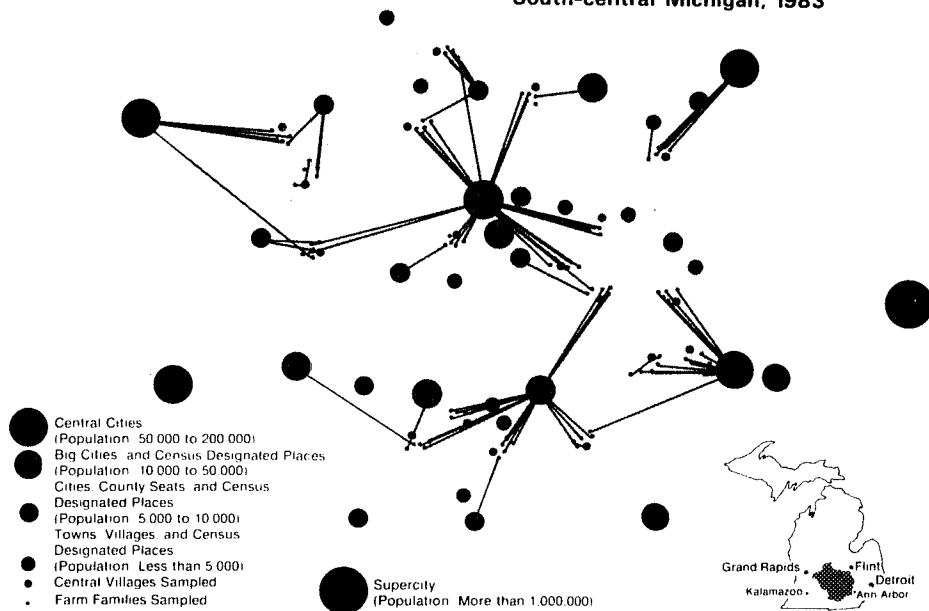


Figure 6.9.1 Shopping travel model of farm families
sampled for family clothing store.

**Rural Non-Farm Families' Shopping Travel:
Family Clothing Store**
South-central Michigan, 1983

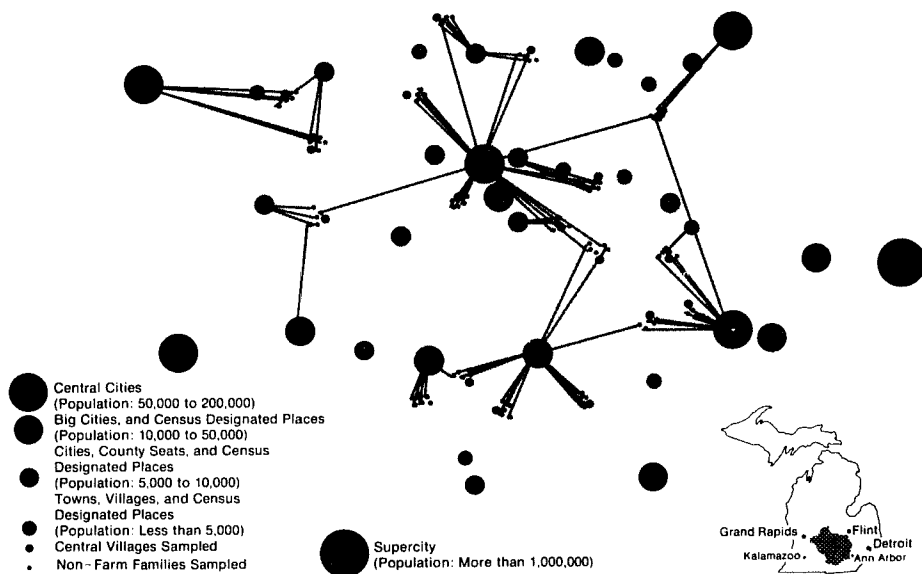


Figure 6.9.2 Shopping travel model of non-farm families
sampled for family clothing store.

Factors Related to Farmers' Selection of Family Clothing Stores in Certain Central Places

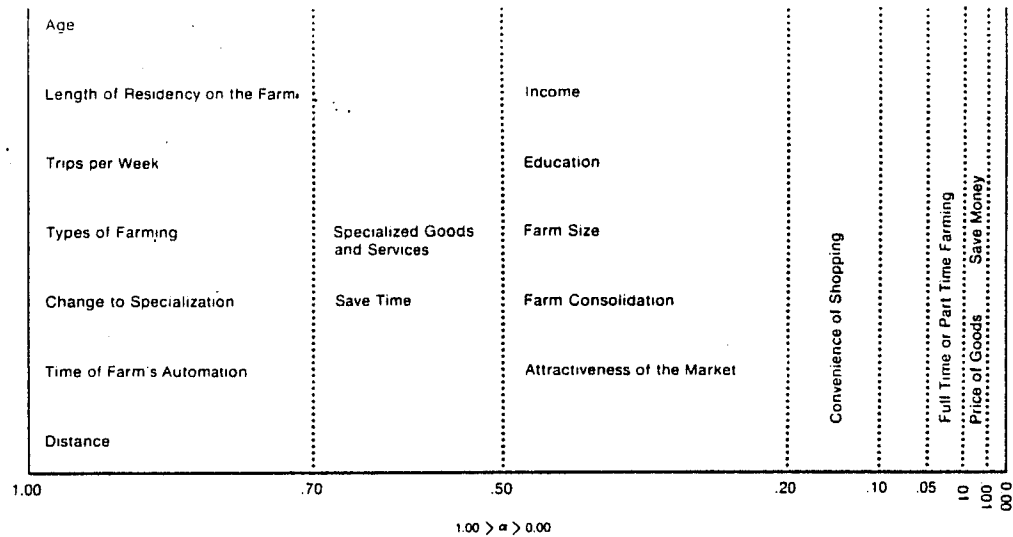


Figure 6.9.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of family clothing stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of family clothing stores.

Factors Related to Non-Farmers' Selection of Family Clothing Stores in Certain Central Places

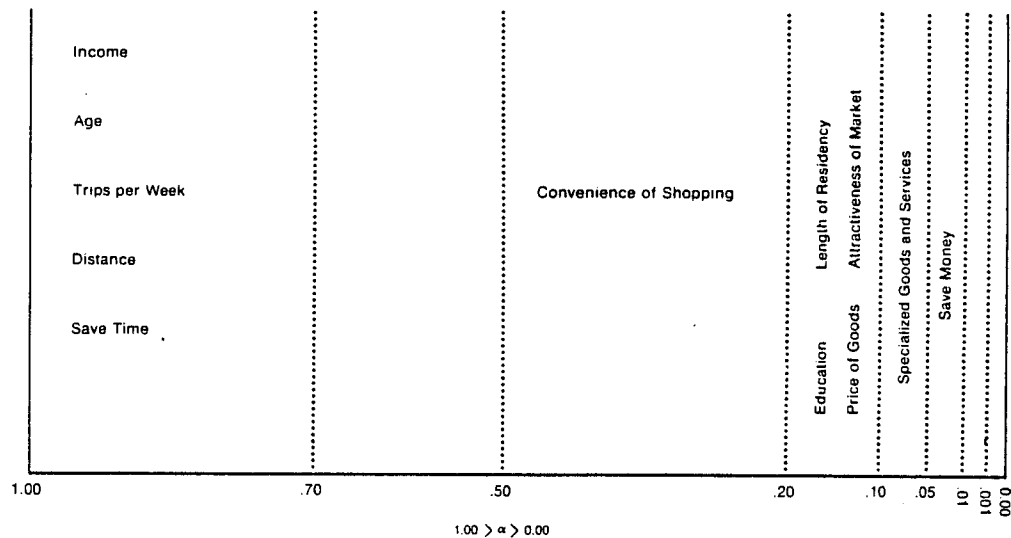


Figure 6.9.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of family clothing stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of family clothing stores.

percent to 90 percent probability of association (Figure 6.9.4) for nonfarm families. Strong phi-coefficients (Tables 6.4.1 and 6.4.2) were obtained for both rural farm and nonfarm families. Thus, price can be considered an influential factor in family clothing store shopping models for rural families of the study area. Concerns about price and saving money among rural families encouraged more out-shopping in the urban central places at the cost of central villages.

The factor of full-time or part-time farming was also significant for the rural farm families' model of family clothing shopping (Figure 6.7.3 and Table 6.9.2). A greater proportion of full-time farmers than part-time farmers in-shopped the local family clothing stores. The patronization of these local stores by some full-time farmers may be related to a lower concern for fashion and style than many part-time farmers who work in the cities. However, the majority of farm families and all of the part-time farm families outshopped the local family clothing stores for the previously mentioned factors of price and money saving considerations. Future increases in part-time farming in the study area will tend to encourage more dispatronization of local family clothing stores to the benefit of these stores in the urban central places.

Considering family clothing as a specialized function helped to influence the shopping model for rural families,

was found to have 90-95 percent of probability of association (Figure 6.9.4) with a strong phi-coefficient (Table 6.4.2). This factor was less significant for farm families at 30-50 percent of probability of association (Figure 6.9.3) and a moderate phi-coefficient (Table 6.4.1). Thus, the specialization of family clothing stores at the urban central places has been an influential factor of rural families' outshopping. It was more influential in the shopping behavior of nonfarm families who tend to be more city-oriented in their shopping than farm families.

The income factor had only a low probability of association with the shopping model for rural farm and nonfarm families (Figures 6.9.3 and 6.9.4). But, the coefficient of strength of association was moderately strong (Table 6.4.1 and 6.4.2), so there was a preference for outshopping among the higher income farm and nonfarm families. For mobility, there was no statistically significant association between their weekly shopping trips and the shopping models of family clothing stores (Figures 6.9.3 and 6.9.4). There was not even any preference for outshopping by more mobile over the less mobile ones. This means that outshopping for family clothing stores in urban centers was dominant at all levels of mobility.

Family clothing stores are a town and city level function which was locally dispatronized by the farm and nonfarm families of the study area. Limitations on variety and

quality and the higher prices of local family clothing increased the dissatisfactions of rural families and encouraged outshopping. The nonfarm families did even more outshopping of local family clothing stores due to their city ties.

Automotive dealers, with a high location coefficient (Table 6.2), were a high order function in central villages over the study time. They appeared as a nontypical function in central villages in 1970 and were retained in 1980 (Tables A.4, A.5, A.6 and 6.2) as a nontypical function. The failure of automotive dealers to become a typical function in any class of central villages implied that the urban automotive dealers have been responsive to the needs of the rural families of study area. There was considerable variation in the shopping models of farm and nonfarm families for automotive dealers. The average mean shopping travel to automotive dealers was fairly low among farm families, but was high among nonfarm families (Table 6.3).

The percentage of rural farm families who supported local automotive dealers was much greater than the rural nonfarm families (Table 6.3.1) and there was an extremely high standard deviation of the rural nonfarm families' travel mileage among all the sampled functions (Table 6.3). This implied that not only were rural farm families more supportive of local automotive dealers, but nonfarm families travelled much greater distances to automotive dealers

in large urban central places, particularly the supercity of Detroit (Figures 6.10.1 and 6.10.2). One of the reasons for these differences was related to the farmers tendency to do their own repairs which reduced their need to visit the more remote urban centers. Nonfarm families were concerned with both sales and services at the automotive dealers' shops. Most of these families had two private cars and they were very tied to city automotive dealers. The function of automotive dealer was flexible in regard to farm families' travel models and was extremely flexible in regard to nonfarm families' travel models toward automotive dealers. The presence of automotive dealers, as only a nontypical function in fourth and fifth order villages in 1980 (Table 6.2) is evidence of their unstable situation. Because this function had a large location coefficient (Table 6.2), it was considered a flexible or competitive function, particularly among nonfarm families.

Among the factors influencing the shopping or visiting model of rural farm and nonfarm families for automotive dealers, distance was statistically important with a strong coefficient of association (Figures 6.10.3 and 6.10.4). Distance was more statistically significant among farm families than nonfarm families (Figures 6.10.3 and 6.10.4 and Tables 6.4.1 and 6.4.2) for reasons related to farmers' preferences for shorter travel distances and their ability to do their auto repairs themselves at their farms. Time

**Farmers' Shopping Travel:
Automotive Dealer
South-central Michigan, 1983**

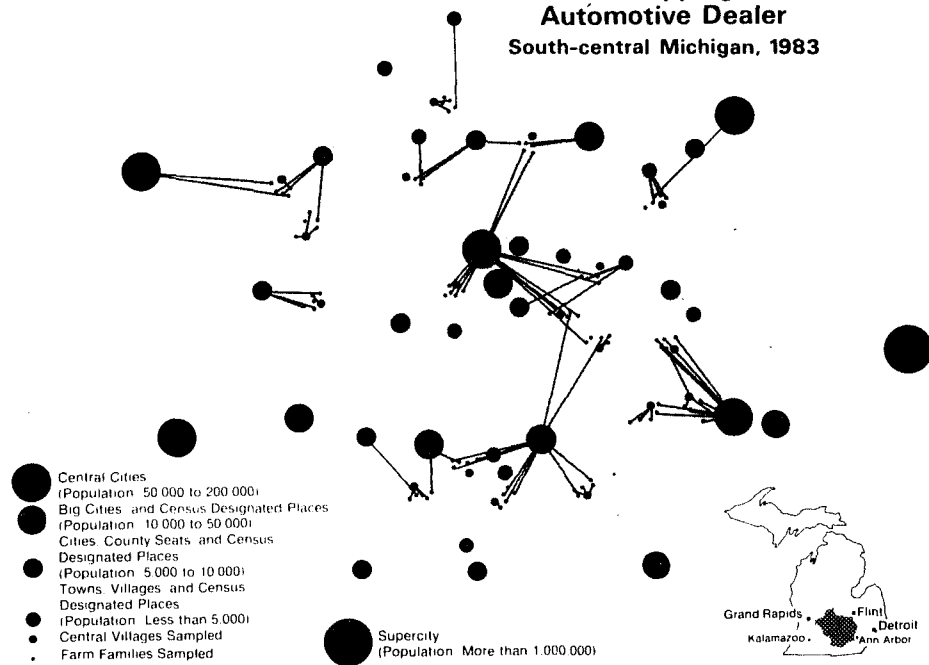


Figure 6.10.1 Shopping travel model of farm families
sampled for automotive dealer.

**Rural Non-Farm Families' Shopping Travel:
Automobile Dealer
South-central Michigan, 1983**

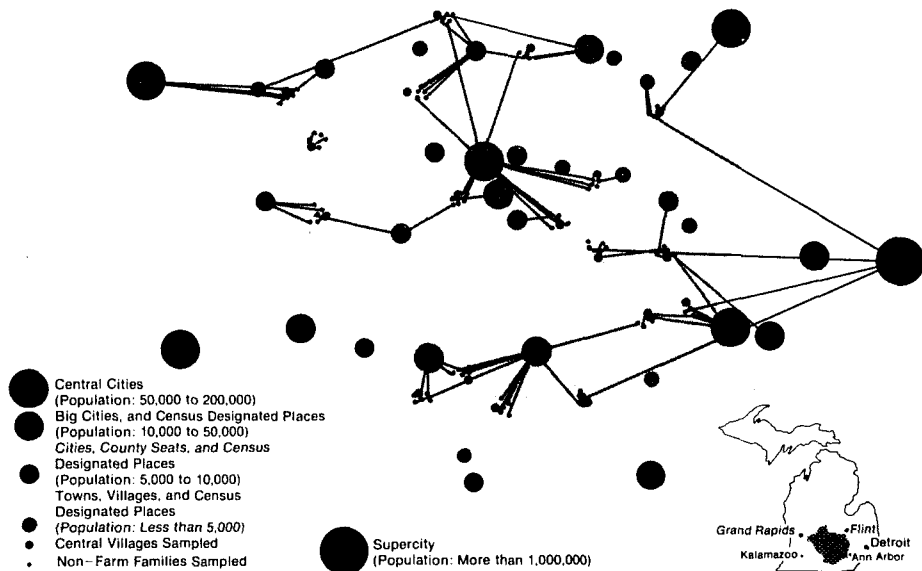


Figure 6.10.2 Shopping travel model of non-farm families
sampled for automotive dealer.

Factors Related to Farmers' Selection of Automotive Dealers in Certain Central Places

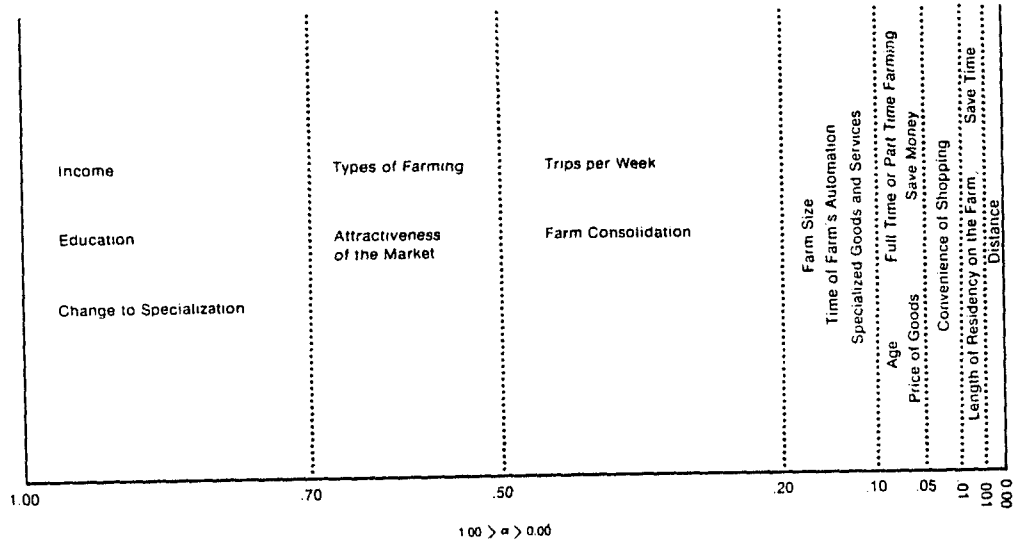


Figure 6.10.3 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of automotive dealers; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of automotive dealers.

Factors Related to Non-Farmers' Selection of Automotive Dealers in Certain Central Places

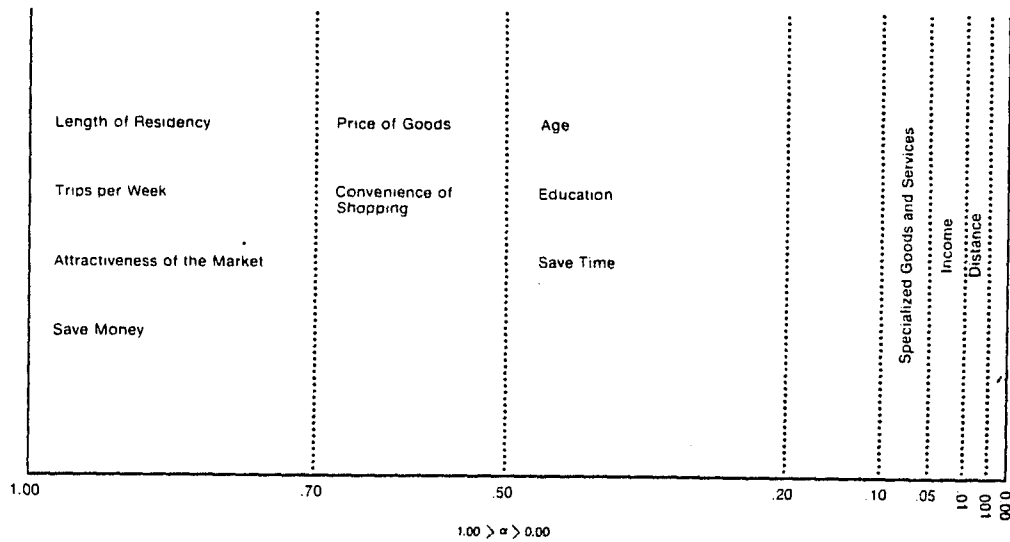


Figure 6.10.4 Chi-Square probability scale: Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of automotive dealers; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of automotive dealers.

savings and convenience were also found significant in shopping models of farm families for automotive dealers and are complementary factors to distance considerations among the farm families. Length of residency was a statistically significant factor in the automotive shopping travel of farm families (Figure 6.10.3). A greater percentage of farm families with longer residency patronized local automotive dealers than farmers with shorter residency. On the whole, however, urban patronization was most frequent at all levels of residency. Full-time or part-time farming had 90-95 percent of probability of association (with a strong phi-coefficient) with the shopping models of farm families for automotive dealers (Figure 6.10.3 and Table 6.4.1). A greater percentage of full-time farmers than part-time farmers patronized local automotive dealers. Thus, an increase of part-time farming is likely to cause increased local dispatronization.

The factor of income was statistically significant in the shopping model of nonfarm families (Figure 6.10.4). In fact, there was a significant trend toward outshopping by higher income nonfarm families who visited an automotive dealer in a city to buy their new cars. Income was not statistically significant for farm families' shopping travel toward automotive dealers which meant that farmers of all income levels have similar shopping travel models for

automotive dealers. Therefore, the other factors discussed such as distance, convenience, etc., were influential.

Shopping trips per week was not statistically significant or strongly associated with the farm and nonfarm families' visits to automotive dealers, but there was some slight preference for outshopping among more mobile farm and nonfarm families.

Speculating on the future of automotive dealers, it should be noted that with future decreases in farms and farm families, and increases of rural nonfarm families with their closer ties to the city, in the study area, local support for this function will be likely to decline. Outshopping may be the final solution.

Shoe stores, another town and city function, had the highest location coefficient among the sampled functions for 1980 (Table 6.2) and has been unstable as a typical function of a certain class of central village in the past (Table 4.8). Its nontypical nature in the fifth order villages in 1980 particularly implied a nonviable status in the central villages studied. There was only a small percentage of rural farm (10.1 percent) and nonfarm families (2.4 percent) who patronized local shoe stores in the study area (Table 6.3.1). The presence of very high means and standard deviations in range of travel toward shoe stores among the farm and nonfarm families indicated that this function is highly flexible and competitive (Table 6.3). The shopping

travel models of both groups revealed significant preferences for shoe shopping in the urban central places (Figures 6.11.1 and 6.11.2). The greater urban patronization of nonfarm families compared with farm families, implies that increases in the nonfarm population of the region will further decrease the already small proportion of local residents who support this function at the village level. Therefore, the elimination of shoe stores from low order villages will be unavoidable. The availability of the shoe store function only in urban central places seems to be the only probable outcome.

The perception of shoe stores as a specialized function, was important in the trend for farm and nonfarm families to outshop the local shoe store. In fact, there was a statistically significant association between the perception of shoes as specialized goods and the selection of a certain shoe store in a particular central place by both farm and nonfarm families (Figures 6.11.3 and 6.11.4). The development of the shoe industry toward greater specialization will further encourage shoe shopping at urban central places by the farm and nonfarm families of the study area.

The price of goods and saving money were also statistically significant factors encouraging an outshopping pattern among farm families (Figure 6.11.3). While prices and money saving considerations were not statistically significant for nonfarm families, there was a moderate coefficient

**Farmers' Shopping Travel:
Shoe Store**
South-central Michigan, 1983

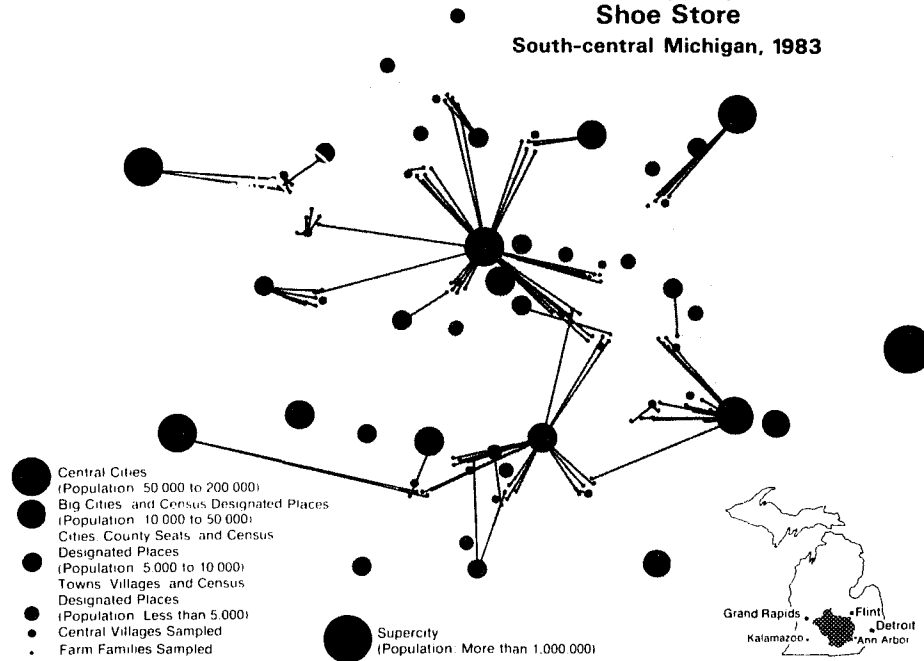


Figure 6.11.1 Shopping travel model of farm families
sampled for shoe store.

**Rural Non-Farm Families' Shopping Travel:
Shoe Store**
South-central Michigan, 1983

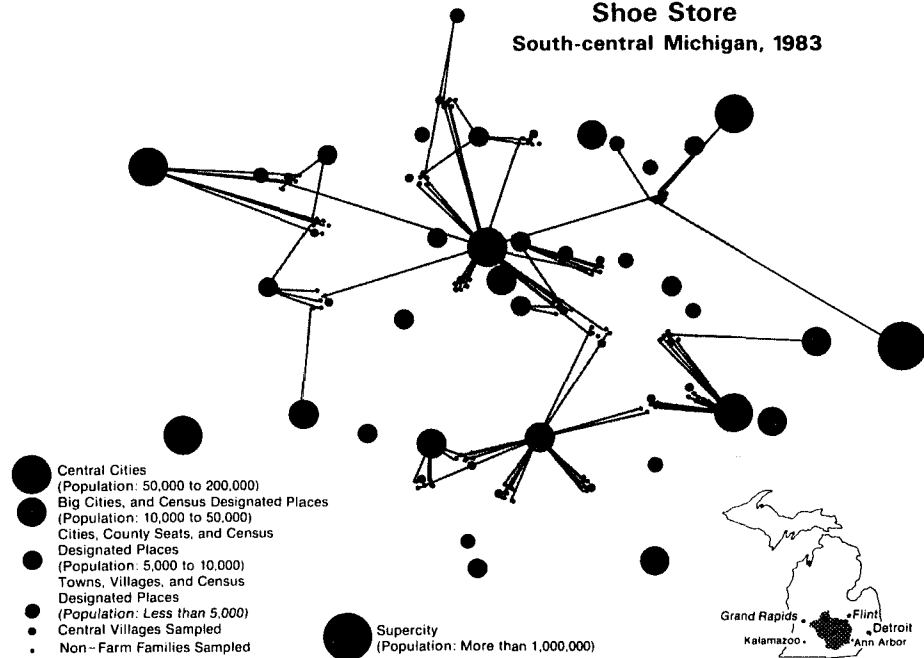


Figure 6.11.2 Shopping travel model for non-farm families
sampled for shoe store.

Factors Related to Farmers' Selection of Shoe Stores in Certain Central Places

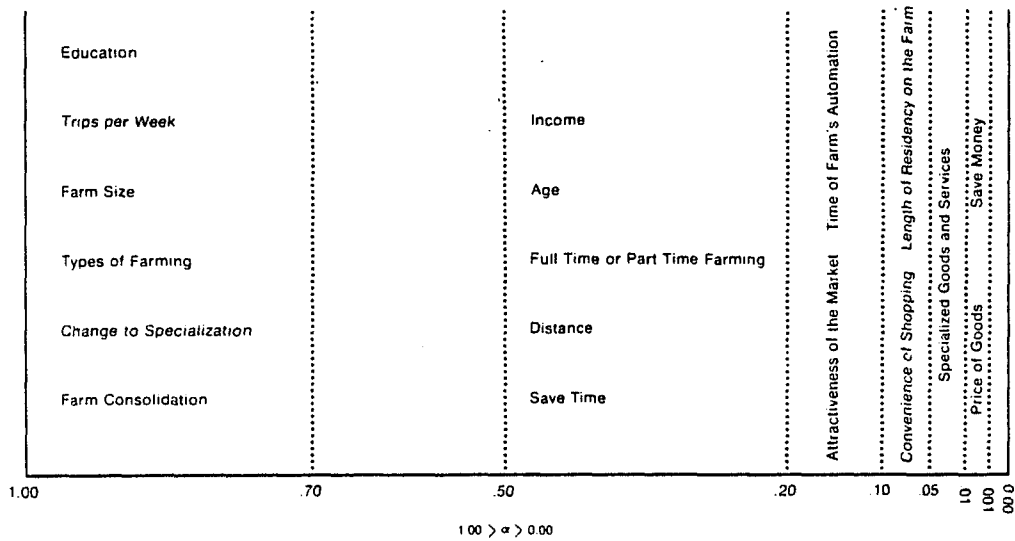


Figure 6.11.3 Chi-Square probability scale. Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of shoe stores and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of shoe stores.

Factors Related to Non-Farmers' Selection of Shoe Stores in Certain Central Places

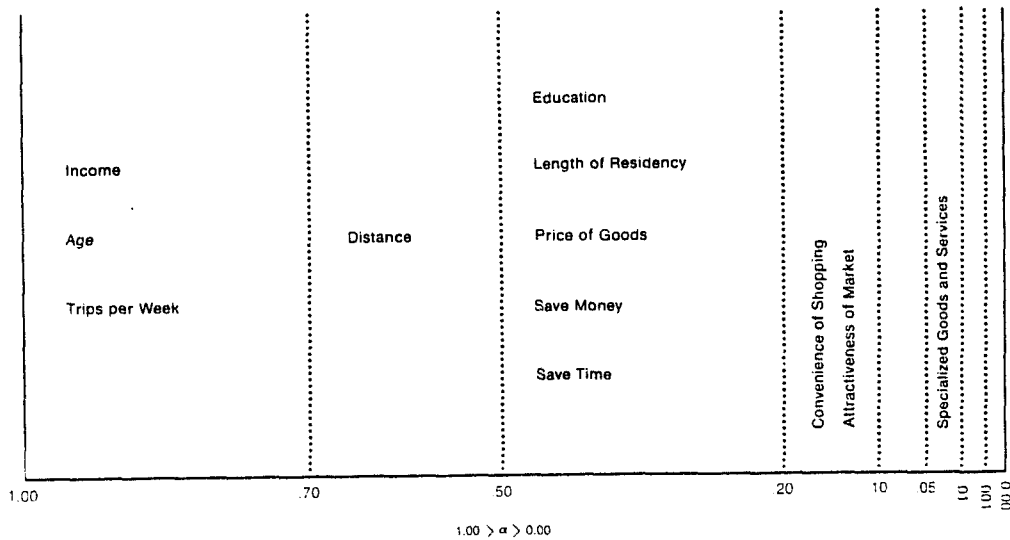


Figure 6.11.4 Chi-Square probability scale. Factors classified between $\alpha = 0.0$ and 0.05 imply statistically significant associations with the selection of shoe stores; and the factors classified between $\alpha = 0.05$ to 1.00 do not have a significant association with the selection of shoe stores.

of strength and 50 to 80 percent probability of association between price and money saving considerations to indicate these factors had some influence in the shoe shopping pattern of rural nonfarm families (Figure 6.11.4 and Table 6.2.4).

Shopping convenience and attractiveness of the market were also significant influences on farm and nonfarm families' shoe shopping (Figures 6.11.3 and 6.11.4 and Tables 6.4.1 and 6.4.2). The factor of attractiveness of the market tended to encourage outshopping for shoes. Shopping convenience had some influence on inshopping among farm families. The convenience factor among nonfarm families was interpreted to mean the convenience of shoe shopping in one of the urban central places--without any reference to local shoe stores. This implies that nonfarmers are more city-oriented in their shoe shopping than farmers, to the extent that they almost fail to perceive that a local shoe store exists.

The factors of income level and frequency of shopping trips were not statistically significant for farm and nonfarm families (Figures 6.11.3 and 6.11.4). This was related to the high frequency of shoe store outshopping by the majority of families at all income and mobility levels.

The future prospects for shoe stores in the central villages of the study area are not bright. As noted earlier, shoe stores were a high order flexible function

that was not locally patronized. As such it is likely to be a nonviable function in the central villages. It was found to be almost exclusively a town and city level function consistent with the preference of farm and nonfarm families for the shoe stores in urban centers. The increase of the non-farm population who have the greater preferences for out-shopping shoes, may eliminate the local shoe stores entirely, to the benefit of shoe stores at urban central places.

General Funding of Factors Influencing
the Shopping Models of Rural Families

According to classical central place theory, distance minimization was always decisive in the behavior of consumers toward shopping opportunities in central places. This deterministic and confusing concept was later modified, first by Losch (1939) who believed that the consumers are biased in their shopping choices for different goods and services. This was verified in the empirical study of Golledge, Rushton and Clark (1966). Other contributors to revised central place theory found that objective factors, such as distance and site attraction (Rushton, 1971), shopping convenience (Williams, 1979), and price orientation (Taylor, 1979), and subjective factors, such as money and time considerations (Burnett, 1973), are important variables that influence the shopping choices of consumers. Indeed,

personal experiences and attributes of individual consumers, such as their income class (Davies, 1969), age, and length of residency (Burnett, 1973), and age and race (Hall, 1983) were also found to be influential in individual shopping preferences for a certain function. The impact of these influential variables (objective, subjective and personal characteristics) thus create varied ranges of shopping for different goods and services. These ranges for several functions have been examined and found to differ due to consumers' behavioral biases and their individual or social peculiarities (Golledge, Rushton and Clark, 1966; Murdie, 1965; Ray, 1967 and Davies, 1969).

It was found in this study that objective and subjective factors and individual characteristics of farm and nonfarm families are influential in their shopping choices toward different sampled functions available in a certain class of central places of the study area.

The factor of distance was found to be statistically significant in shopping travel models of farm and nonfarm families toward lower order functions such as grocery stores, optometrist, and clinic. Therefore, distance is a factor in the support of such functions at the level of sixth order villages (grocery) and third order villages (optometry and clinic). Distance considerations were not significant for higher order functions, with the exception of automotive dealers (city level function) whose proximity

to rural residents was important due to local needs for auto repair.

Price was another influential factor that was found to be statistically significant in farm and nonfarm families' shopping travel models toward the first order village functions and town and city level functions (paint and wall-paper stores, department store, family clothing store, and shoe store). The automotive dealer was again an exception because of its dual function of sales and service. Price, however, was statistically significant among the farm families' choices of automotive dealers; it had less importance among the nonfarmers. In general, the price influence on high order functions was responsible for the relative flexibility of these functions that compete with similar functions in the urban central places of the study area. These local functions tend to be disadvantaged in quality of goods, quantity of selection, and prices compared with stores in urban central places that profit from economies of scale and volume buying.

Shopping convenience was found to be important for almost all of the sampled functions that existed at different levels of central places. Farm families were influenced more by convenience aspects than nonfarm families. Thus, the convenience of being able to shop locally for a function generated some local support for various functions from farm families, but the same functions, available in urban

central places, were considered convenient by the nonfarm families. This factor in particular illustrates the rural nonfarm families' close ties to the city compared with farm families. The specialized nature of functions such as clinics and optometrists (third order village functions), floor covering stores (second order village functions), department stores (first order village function), and shoe stores (town and city level functions) was an influence that encouraged outshopping by the farm and nonfarm families, particularly the nonfarm families.

Saving money was statistically significant in farm families' shopping for a second order village function (floor covering), first order village function (paint and wallpaper and department store) and the town and city level functions (family clothing and shoes). It was an influential factor for nonfarm families but not statistically significant. The reason is related to the greater percentage of outshopping at urban central places done by the rural nonfarm families.

Saving time was observed to be statistically significant for farm families shopping models for third order village functions (optometry, clinic) and town and a city level function (automotive dealer). It was found to be influential but non significant among nonfarm families. The results of this difference are evident in the farm families' stronger patronization of local enterprises compared with the nonfarm families, who generally travel longer distances

and whose shopping preferences are generally oriented toward urban central places. Therefore, to save time they choose the most accessible urban central places.

The factors of age and years of residency in present location were found statistically significant in some of shopping or visiting models of rural families. The factors of age and years of residency were found statistically significant for farm and nonfarm families' shopping for the sixth order village function (grocery stores). There was a greater percentage of grocery outshopping by young farm and nonfarm families who had had shorter residency compared with the middle aged and elderly. For visits to the optometrist, a third order village function, the elderly farm and nonfarm families tend not to patronize the local optometrist. Local clinics (third order village function) are patronized heavily by young nonfarm families. The local paint and wallpaper stores (first order villager functions) were especially favored by the nonfarm elderly. Meanwhile, visitations to local clinics and paint and wallpaper stores by farmers were not statistically significant. In fact, farm families of different age levels patronized these local functions almost equally. As a conclusion, any future changes in the age structure, length of residency and non-farm proportion of rural residents is likely to affect the viability of sixth order, third order, and first order village functions.

The factors related to the characteristics of farm families, including farm consolidation and types of farming, were not found to be statistically significant in farmers' shopping models, but had some influence. There was some preference for inshopping among the farmers who had consolidated their farms and those in general farming. Considering the present decline of farming and farm families, this local support is not likely to be very influential in the future development of the villages.

Full-time or part-time farming was an attribute of farm families that was found to be important in their shopping models for third (clinic), second (jewelry) and first (department store) order village functions and town and city level functions (family clothing, automotive dealer and shoe store). There was a greater tendency for inshopping by full-time farmers. Given the continuous decline of full-time farmers and increased part-time farming, the viability of central villages can be expected to decline further in coming years.

Income levels and frequency of shopping trips were also examined, but there were no statistically significant associations between these factors and rural families' shopping models for different class of functions. There were, however, some tendencies noted in preferences for outshopping local goods and services by higher income and more mobile farm and nonfarm families. The major influence in weakening

the importance of farm and nonfarm families' income level or mobility level was related to their preference for out-shopping (bypassing) the central villages at every income and mobility level in favor of shopping at the urban central places.

Overall, it was found that the rural families outshopped the central villages, due to the absence of needed goods and services and because of greater selection opportunities in larger central places (urban centers), with more variety and better prices and the availability of numbers of shops in an urban mall or shopping center. In fact, the rural families' satisfactions and dissatisfactions with the local opportunities available in the central villages were the most important factor in their shopping models of sampled functions. The presence of a high percentage of outshopping among rural families for all sampled functions (Table 6.3.1) implied their preference for selection opportunities existing in large central places of the study region. This supports a similar finding in the empirical study of Brooker-Gross (1981) for outshopping the shoe stores available in local towns by permanent and non-permanent (student) residents.

From the questionnaire data gathered in the survey, it was found that 37 percent of farm families completely bypassed the central villages and 50 percent of the nonfarm families did so. The evidence implied that the dissatisfaction of rural families in study area with local

functions started very early in the smaller central villages and only appeared later in the larger and more viable central villages of southcentral Michigan which offered more varied functions. As discussed in Chapters Three and Five, regional development has brought regional accessibility to the rural families of the study area and provided a competitive marketing space for all these central villages. Therefore, locational factors and individual preferences have influenced outshopping of the local central functions of these villages.

The regional development of the study area over the study time has brought increased income and mobility to the farmers that have encouraged outshopping, but, the drawing power of urban central places that offer more sophisticated shopping opportunities, with better quality merchandise, greater variety and cheaper prices has been the major influence on families at all income and mobility levels. This was evident in the inferential chi-square probability tests that were used to examine the factors of income and mobility and found them to be statistically non-significant in shopping models of rural families. Indeed, the decline of farms and farm families and increase of nonfarm families in the study area (due to rural development) has been very influential in the declining viability of central villages. Continuation of this trend will cause further decline in the class order of central villages.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND FUTURE SPECULATION

The purpose of this research was to examine and analyze changes in the viability and spatial distribution of the central villages of southcentral Michigan over the periods of 1950-1970 and 1970-1980, particularly in response to significant rural and regional development in the study region.

The southcentral Michigan area offers a homogeneous physical environment characterized by general and dairy farming, as well as substantial nonfarm rural settlement. Forty-six villages were distributed over the study area and it was hypothesized that the spatial distribution (geometric arrangements) of these central villages, due to rural development and farmers' preferences, would have changed over time. Indeed, it was hypothesized that the rank size rule (a continuous relationship between the population size of villages and the number of their functions) and the hierarchical structure that existed had been changed over the periods of the study. Rural development in the study area, including agricultural industrialization, transportation development and consequent changes in the pattern of

population distribution over the two periods of 1950-1970 and 1970-1980 was hypothesized to be one of the most essential factors of change in the viability and spatial distributions of central villages. It was further hypothesized that changes in the viability and spatial distribution of central villages would be found to derive from certain preferences of rural families.

Significant agricultural industrialization of the farm landscape with concurrent super highway development has occurred in southcentral Michigan. The increase of regional accessibility and the increase of farm families' gross incomes were the consequences of rural development in the study region. Farm depopulation (due to agricultural industrialization) was accompanied by repopulation with non-farm families who commuted to jobs in the cities, but took advantage of super highway developments to live in less expensive, less crowded rural areas.

To compare the functional changes of central villages due to rural development over the study periods, a functional index classification was chosen that provided an objective method and showed the hierarchical pattern of central functions in central places. Using a functional index classification gave the values of location coefficients for each central function and the functional index values for each central village. The functional index values were then divided into six classes using the Jenks method and F-tests

(analysis of variance) that showed a strong hierarchical structure among the six classes of central villages at three points in time (1950, 1970 and 1980). The classification of central villages into these six groups at three points of time became the mechanism for modeling and analyzing them in a spatial and temporal framework.

Due to rural development and consequent changes in rural functions, the decline of farmers and increase of non-farm families in the study area, the model of the hierarchical structure of central villages changed over the study periods. Changes in the types and numbers of rural functions and number of functional units (stores), created different models of the hierarchical structure of central villages. Indeed, the threshold population for each hierarchical class of villages lost its importance as a factor of economic growth of a particular class over time. Using continuous models to show the general trends of population and functional relationships of central villages over the study time, revealed a strong linear relationship and positive correlation coefficients among the variables. This continuous linear relationship between population and function in central villages weakened over the study time due to the declining importance of population as a factor of economic growth and viability in central villages.

The continuous model was also used to determine the threshold population for some sampled functions over the

study time with the result that threshold populations were found to differ for different orders of central functions. Accordingly, it was found that lower order functions, such as grocery stores, could survive with the support of a small population, while the higher order functions, such as department stores, required a larger range of population support. Since the impact of transportation development increased the regional accessibility of the rural families of the study area over the study periods, the threshold population required for the survival of a central function generally increased as that function came into greater spatial competition with similar establishments in the larger central places of the study area.

The temporal dimension for this empirical study was useful in examining the changes in the spatial distribution (geometric arrangement) of the six orders of central villages over the study times. It was found that the regular (dispersed) pattern implied in original central place theory did not exist for all the classes of villages at the three points in the study time. Using nearest neighbor analysis, there was a general tendency toward random patterning of central villages in the period from 1950 to 1970, while the pattern varied from random toward dispersed patterning from 1970-1980. Regional development in relation to rural families' preferences for inshopping or outshopping the central villages was responsible for these spatial changes.

The adoption of agricultural industrialization among the rural farm families of southcentral Michigan and the significant super highway development in the region over the study periods was responsible for changing the viability and spatial distribution of central villages. Several older functions that were required by the rural farm families in 1950 then became outmoded and disappeared from the central villages studied by 1970. The disappearance of general stores from these villages over the 1950-1970 period, for example, was accelerated by the increased practicality and popularity of local and urban department stores that had been established in the study region by 1970. Indeed, the development of rural super markets in the central villages in the period between 1970 and 1980, in their turn, reduced the demand for local department stores in favor of urban department stores. The function of blacksmithing, and shoe and harness repair, also available in central villages in 1950, were demanded locally by farmers who were still using horses for farm work. These functions had disappeared from central villages by 1970, when tractors and other machinery had taken the place of horses as farm work power.

The increase of tractors and cornpickers bringing agricultural industrialization to the farm landscape in the period of 1950-1970 was also influential in increasing the number of farm and machinery dealers, fuel oil and petroleum and gas dealers in central villages during that period. The

old farm machinery shops available in central villages in 1950 were replaced by or developed into farm equipment dealers (in 1970), who introduced the most recent and sophisticated farm machinery and supplies to the farmers. This trend was supplemented by the appearance of another farm-oriented function, farm and garden machinery stores, in the 1970-1980 period, which were related to an increasing interest in part-time and hobby farming among the rural families. Technological advancements in trucks and automobiles and the increased usage of trucks by farmers and motor vehicles by rural nonfarm families, who commuted to cities for their jobs, over the periods of the study also caused the disappearance of general machine shops that were available in central villages in 1950 and the introduction of motor vehicle dealers by 1970 and their increase from 1970 to 1980. Meanwhile, the decline in the number of gasoline service stations and auto supply and equipment in the central villages over the study periods was related to the consolidation of these functions in larger central places (economies of scale) due to the greater accessibility provided by super highway development in the region. Thus, technological advancements in transportation were influential in changing the spatial distribution of central functions in the central villages over the study periods.

It was found that, in the central villages studied, retail and wholesale reductions were consistently more

severe in lower order central villages than in higher order villages over the study time. The declines in grocery stores, hardware stores, gasoline service stations, drug-stores, furniture stores, jewelry stores and the like were examples of reductions in retail functions in the central villages caused by rural families preferences for urban shopping. It should be noted that first and second order villages of the study area were less affected than lower order central villages by the process of regional rural development. In fact, higher order central villages also experienced decline in retail functions in competing with urban centers, but it was less severe than the lower order central villages, which are presently economically non-viable central places in the study region.

Significant changes in agriculture and transportation in southcentral Michigan increased part-time farming and the nonfarm population in the rural townships of the study area. Farm mechanization and consolidation caused the exodus of many farm families from the rural landscape as large-scale farming (consolidated and corporate farms) resulted in economic hardship and finally the disappearance of many small farming operations. This trend was accompanied by an increase in part-time farmers who do not depend entirely or even mostly on their farm incomes. For part-time farmers, their increased mobility has been helpful in allowing them to take jobs in the cities. The depopulation of the rural

landscape (due to agricultural industrialization) has been accompanied by repopulation since the 1960s with rural nonfarm families who have jobs in the urban centers of southcentral Michigan. Of the rural townships of the study area, 96 percent gained population between 1950 and 1970 and all of them gained population in 1970-1980. All of the central villages gained population in the first period and 65 percent of them increased their populations in the second period. The trend of rural population growth was encouraged and promoted by the transportation development in the region. Nonfarm residents since the 1960s and recreation seekers since 1970s have sought rural villages for cheaper living and housing costs and the quiet, beauty and pleasures of the rural atmosphere. The increase of part-time farmers and rural nonfarm families in the study area accompanied a decline in patronization of some local central functions in central villages. On the other hand, the emergence and increase of mobile home dealers, hobby shops, and outdoor advertising services in the central villages between 1970 and 1980 were also related to the increasing rural population and the significance of rural recreational activities. The rural population growth was influential in increasing the residential function in central villages and rural services or professions such as churches, doctors, and attorneys (except schools and hospitals) in the central villages studied. It should be noted that declines in the retail and

wholesale activities of these villages as a result of regional development were slightly offset by increased residential, social and community functions.

The impact of rural development and bypassing of the central villages by rural families was more decisive in the first period of the study (revolutionary period) in reducing retail activities than the second period (evolutionary) in the six orders of central villages. This hierarchical order of central villages was important in changing their viability and consequently their spatial distribution. It was found that first order villages were the most viable centers and the sixth order villages were the least viable centers among the central villages studied. All six classes of central villages experienced reductions in their retail sections but they were generally most harmful for the lower order central villages. First order villages, as the most viable central villages, offered industrial (manufacturing), agribusiness, recreational and residential functions, as well as job opportunities and some specialized farm-oriented stores and fairs. The second order villages also grew in both periods of the study. They also faced declines in retail activities, but their status in the second rank of the hierarchical structure of central villages, helped to retain their economic viability for survival. They offered some industrial functions (manufacturing), agribusiness,

recreational and residential functions. While their job opportunities were fewer and they were less economically important than the first order villages, they may tend to remain stable in the future development of this region. Third, fourth, fifth and sixth order villages, as the lower ranks of the hierarchy, combined agricultural and residential functions with weak economic viability. Considerable decline in their viability over the study periods indicated that they were very sensitive to the influences of regional development. The decline of sixth order villages to the level of a hamlet particularly revealed the weaknesses of low order central villages in the face of rural and regional development. The fifth, fourth and third order villages may also gradually decline to hamlet level in the future development of the study area.

The changes of viability in the central villages caused changes in their number and spatial distribution. Generally, the first and second order villages grew or stabilized in their numbers in the study periods, while the rest of the central villages underwent various fluctuations. The spatial distribution of first and second order villages and their development in the southern part of the study region (below the intersection of I-69 and I-96) was due to the attraction of the super highways and auto industries of Detroit and indicated that industrial and manufacturing growth was supportive for their economic viability. Conversely, the spatial distribution and development of third,

fourth, fifth and sixth order villages in the southern part of the study area was limited and they were more likely to be found north of the I-69 and I-96 intersection in areas that were more agriculturally oriented. In fact, the super highway development has promoted industrial orientations in high order central villages, while lower order villages have not benefitted to the same extent from this advantage for their economic growth.

There is no doubt the rural development in the study region was accompanied by increased regional accessibility and gross farming incomes over the study periods. It was also found that rural families were more mobile than in the past due to technological developments in transportation. Thus, they have been able to bypass most of the central villages in favor of shopping in the urban centers where the selection of goods and services of better quality and quantity has been made conveniently available to them. The gross income of farm families was found to have significantly increased (due to agricultural industrialization) in the countries of southcentral Michigan over the study periods. This increase of farmers' gross income and mobility occurred at the same time as the central villages' retail and overall decline in viability, but the two events were not shown to be closely related. Increased mobility and income levels of rural families were found not to be statistically significant in most of their shopping models.

It was found that the important factor of outshopping (bypassing) the local central functions in the villages was related to the patronization of urban centers by the majority of all rural farm and nonfarm families, rather than those from any particular level of income or mobility. There was some preference for outshopping noted among higher income rural families, but it was not statistically significant. Therefore, it could be said that the increased mobility and income of farm families over the study periods accompanied the severe decline in the retail viability of central villages that occurred when the villages were bypassed by the farmers. This finding was based on a non-statistical examination, due to a lack of data on the history of residents' shopping performances in the past.

The concept of various ranges for different functions was found to be relevant as the research showed that rural families were biased in their shopping travel for different central functions. Rural families employed shorter ranges of travel for lower order functions and longer ranges of shopping travel for higher order functions. The nonfarm families consistently had greater ranges of shopping travel compared with the farm families in the study area. Therefore, the nonfarm families' shopping behavior that was primarily city-oriented, provided for greater spatial interaction among local central functions and the central functions of urban central places. Farm families, who had

shorter ranges of shopping travel, provided for the observation of limited spatial economic interaction between local businesses and urban businesses. It should be noted that the increase of regional accessibility for rural farm and nonfarm families has been an important factor in producing the longer ranges of shopping travel for different functions over the study time. Rural development, the increase of rural nonfarm families and individual and social differences between farm and nonfarm families have been influential in the growth or decline of central villages. It was found that greater accessibility favored the outshopping of local functions by rural families; and that rural nonfarm families have played the greater role in local dispatronization of village functions.

The grocery store as an inflexible sixth order village function had the smallest standard deviation in shopping travel and highest percentage of local inshopping by the rural farm and nonfarm families. The spatial flexibility of third order village functions (optometrist and clinic), second order village functions (floor covering store and jewelry), first order village functions (paint and wallpaper store and department store), and the town and city level functions (family clothing store, automotive dealer, and shoe store) resulted from greater ranges of shopping travel and proportionately greater outshopping by the rural nonfarm families compared with rural farm families. Further

increase in rural nonfarm families will be harmful for the present order of rural central functions and a concentration (polarization) of these functions at the next higher class of central villages may be the best possible solution. It was observed that decline in the viability of central functions has been accompanied by loss of their status as typical functions of a certain class of central villages to typical functions of the next higher order class over the study time. These experiences can aid future speculation on this research.

In order to determine the factors influencing the shopping models of rural families in regard to a certain function, chi-square tests were applied to test the hypothesis that individual differences were statistically significant in creating those shopping models. The results showed that the distance was statistically significant for rural families' shopping models of sixth order and third order village functions. The distance aspect was more significant among farm families than nonfarm families. However, for future reallocation of sixth order village and third order village functions, distance (proximity) considerations in regard to the proportion of farm and nonfarm families in the study area, should be taken in account.

Price was found to be statistically significant among the rural families' shopping models for first order village and town and city level functions. Price considerations

were related to the better quality and quantity of goods at lower prices that were available in urban central places. The price influence on the shopping decisions of farm families was related to their choice between local stores or urban stores; among nonfarm families, price considerations were mostly related to a selection of stores among different urban central places. This is consistent with the greater dispatronage of local stores by nonfarm families.

Convenience of shopping a central place function was found almost to be statistically significant and highly influential among the rural families of the study area. The farm families' concern for shopping convenience was more obvious and they were village and city oriented. But, non-farm families were city-oriented in making the most convenient choice of shopping centers. The specialized nature of some goods and services of central places also encouraged out-shopping the local stores. This was more prevalent among the rural nonfarm families.

Saving time in shopping travel models of rural families was found to be influential for sixth and third order village functions and was more important for farm families than non-farm families. However, the time saving considerations of rural families, particularly farmers, tend to support low order local functions. Saving money was found to be significant in shopping models of rural families, particularly

the farm families, for second and first order village functions and town and city level functions. Money saving considerations are thus employed for high level functions that are more competitive. Concern for saving money is a factor in outshopping the local stores of first and second order villages.

Factors such as age, and length of residency, were found statistically significant for some of the sampled functions. There was generally a greater patronization of local functions by young nonfarm families (with short residency) and older farm families (with long residency). Because the percentage of young nonfarm families is low (8.7 percent of nonfarmers) their local patronage will not be as supportive as the older (elderly) farm families who represent 24.3 percent of farm families. Thus, the future decline of farm families and continuing increase of nonfarm population will not be likely to generate central village development.

The attributes related to farm families were not statistically significant in most cases although there was a greater tendency toward inshopping among full-time farmers than part-time farmers. Generally, full-time farmers have deeper socioeconomic and cultural ties with the local central villages than part-time farmers who have jobs in the urban centers. The increase in the number of part-time farmers and decline in the number of full-time farmers in

the study area over the study time was another aspect of the continuing dispatronage of local functions at the central village level to the benefit of urban central places.

Rural residents' dissatisfaction with the local shopping opportunities in central villages was influenced most by more convenient and economical access to urban centers with varied, high quality, lower priced goods in attractive malls and shopping centers. This factor was most influential in the rural families' shopping and visiting models and was prominent throughout the explanations of rural families surveyed. The dissatisfaction of rural nonfarm families with local shops was much greater and started earlier than the farm families.

It is appropriate to speculate briefly on the future prospects for the viability of these central villages and their characteristic functions in this study. First, the consolidation (polarization) of central functions in higher order central villages seems to have been a function of the application of economies of scale in this area. It was found that school consolidation in the first order villages was more efficient and economical than the dispersed distribution of smaller schools in all classes of central villages. School consolidation upgraded the average number of schools in the first order villages and decreased the average number of schools in other classes of central villages. However, the consolidation and concentration of

rural schools in the first order villages, as a policy of polarization for future development, has economic advantages and may be unavoidable. Grocery stores which were another sixth order village function remained typical functions in all classes of central villages over the study time. The continuous and considerable decline in grocery stores has reduced their status as the sixth order village function to the fifth order village function. Therefore, grocery stores and all the central functions in the same class of location coefficient, such as hardware stores, gasoline service stations, drinking places and grain elevators, may be future fifth order village functions (available at fifth, fourth, third, second and first order villages).

Increases in the number of local optometrists and clinics (third order village functions) in the central villages studied, had changed their status as first order village functions to third order village functions over the period from 1970 to 1980. Due to considerable local out-visitation of rural nonfarm families, these functions are likely to be polarized only in second and first order villages.

Jewelry stores were consolidated over the study time to become a typical function of first and second order villages by 1980. The strong typicalness of jewelry stores in first order villages and their weak typicalness in second order villages, in light of the small percentage of jewelry

inshopping by rural farm and nonfarm families, suggests this function is likely to be polarized within the first order villages in the years ahead. Other second order village functions such as the floor covering store and radio and TV repair shops may similarly be polarized at the level of first order villages in the coming years.

Department stores, a typical function of first and second order villages in 1950, was typical only in first order villages in 1970 and 1980, which suggests that the concentration or polarization of this function in first order villages has already been necessary. The central villages studied can rely on maintaining department stores only in the first order villages; their future development should not be anticipated. The other first order village functions such as paint and wallpaper stores, data processing services, electrical and electronic repair shops and motorcycle dealers, like department stores, may be retained at their present status as first order village functions, otherwise they may be town or city level functions.

The presence of town and city level functions such as family clothing stores, automotive dealer, and shoe store in low order central villages in 1980, represented a highly unstable situation. Regarding the increase in the study area's nonfarm families who widen the range of spatial interactions between central villages and urban central places, these high level functions can not survive in that

big competition. Thus, their polarization in the towns and cities of the study area is the ultimate solution to their declining viability.

First order villages are the best possible centers for concentrating or polarizing flexible central functions; second order villages would be the next best choice. The least viable third, fourth, fifth and sixth order villages cannot be considered appropriate centers for concentrating or polarizing flexible functions as they are only marginally viable for inflexible and low order functions. Since the various aspects of consumer behavior were found to be quite influential in determining the viability of central functions, future rural retail or service development in this area (microscale region) should consider these findings. Indeed, the changing pattern of rural population, including the farm and nonfarm families, of the study area should be considered seriously in any regional planning of these central villages in the future.

A P P E N D I X : A

TABLE A.1. CENTRAL FUNCTIONS, LOCATION COEFFICIENTS AND FUNCTIONAL INDICES OF CENTRAL VILLAGES, 1950.

Village	T A	T B	T C	T D	C* A	C* B	C* C	C* D	C* E
1. Chelsea	9	1	2			8		1	3
2. Lake Odessa	4		1		5	1	2	1	
3. Dexter	5		3	1	1	3		1	3
4. Fowlerville	3	1	1		2	6		1	
5. Nashville	5	1	3		5	1	2		
6. Manchester	4	3			1	5			3
7. Brooklyn	1	1			3	5			
8. Bellevue	2				3	1			2
9. Homer	4		3			7	1	1	
10. Stockbridge	3		2		1	2		1	
11. Linden	1	1	3			6			2
12. Grass Lake	2				3	4			
13. Pinckney	5		1			4			2
14. Saranac	2		1		5	1	2	1	1
15. Ovid	6				2	4		1	
16. Webberville	3		1		1	6			
17. Fowler	2					2		1	
18. Parma	2	1				3			1
19. Pewamo	1		2		1		1	1	
20. Springport	4		2			3			
21. Caledonia	1		1		2				1
22. Addison	5	1			1	4	1		
23. Muir	2		1		2		1		
24. Concord	2				1	2		1	
25. Morrice	2					3	1		
26. Clarksville	1		2		3		2	1	
27. Vermontville	4		2		3		2		1
28. Byron	2		2		1	1	1		
29. Lennon	3				2	3			2
30. Dimondale	3				2		1		1
31. Maple Rapids	2					2			
32. Sunfield	2		1		4		2		
33. Woodland	2				3	1			
34. Bancroft	2					4	1	1	
35. Muliken	4		1		4		2		
36. Westphalia		1			2		1	1	
37. Gaines	2				1	2			
38. Vernon	2		1			3			1
39. Hanover	1	1	1						1
40. Freeport	1		1		2		2		
41. Lyons	1				1				
42. Dansville	1				1	2			1
43. Perrinton						2		1	1
44. Hubbardston					1	1	1		
45. Cement City	2					4	2		
46. Eagle	1				1	1			
Total Functional Units	116	12	38	1	70	107	28	15	26
Location Coefficient	.86	8.33	2.63	100	1.43	.93	3.57	6.66	3.85

Source: Author's collections based on Dun & Bradstreet Reference Book, 1950.

TABLE A.1. (CONTINUED)

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Village	C* F	C* G	C* H	C* I	C* J	C* K	C* L	11 A	11 B
1. Chelsea			2						
2. Lake Odessa			3	2	1				1
3. Dexter		1		2		1			
4. Fowlerville	1			3					2
5. Nashville				2				1	1
6. Manchester	1			4				1	
7. Brooklyn			2	3					1
8. Bellevue	1		1	2					1
9. Homer			1	1				1	1
10. Stockbridge				4					1
11. Linden			1	2					
12. Grass Lake				1					
13. Pinckney				1					1
14. Saranac			1						
15. Ovid				1				1	
16. Webberville			1				1	1	
17. Fowler			1	3					2
18. Parma						1			
19. Pewamo					1			1	
20. Springport					1			1	
21. Caledonia			1	1					1
22. Addison				1					
23. Muir									
24. Concord	1			1				1	
25. Morrice		1	1					1	
26. Clarksville									
27. Vermontville				1	1			1	
28. Byron								1	
29. Lennon								1	
30. Dimondale									1
31. Maple Rapids			1						
32. Sunfield									1
33. Woodland									1
34. Bancroft	1								
35. Muliken									
36. Westphalia				1					2
37. Gaines								1	
38. Vernon									1
39. Hanover			1						
40. Freeport									
41. Lyons				1				1	
42. Dansville									
43. Perrinton								1	
44. Hubbardston									
45. Cement City									1
46. Eagle									1
Total Functional Units	5	2	17	37	4	2	1	15	20
Location Coefficient	20	50	5.88	2.7	25	50	100	6.66	5

TABLE A.1. (CONTINUED)

Village	11 C	11 D	11 E	E A	E B	E C	[A	[B	[C
1. Chelsea	1	1	1	1	1			1	
2. Lake Odessa				3					
3. Dexter					1				1
4. Fowlerville		2	1	1	1				
5. Nashville				1					
6. Manchester				1	1				
7. Brooklyn					1	1			
8. Bellevue	1			1					1
9. Homer			1			1	2		
10. Stockbridge			1	1		1			
11. Linden	1			2					
12. Grass Lake		1		1		1		1	
13. Pinckney					1				
14. Saranac			2	1	1				
15. Ovid	1			2	2		1		
16. Webberville						1		1	
17. Fowler									
18. Parma		1		1	1				
19. Pewamo									
20. Springport						1			
21. Caledonia				1					
22. Addison	1			2					1
23. Muir				1					
24. Concord			1	2	1				
25. Morrice					1				
26. Clarksville				1					
27. Vermontville			1		1				
28. Byron				1	1				
29. Lennon						1			
30. Dimondale				1					
31. Maple Rapids			1						
32. Sunfield						1			
33. Woodland				1					
34. Bancroft									
35. Muliken			1						
36. Westphalia									
37. Gaines									
38. Vernon				1					
39. Hanover									
40. Freeport									
41. Lyons				2					
42. Dansville									
43. Perrinton									
44. Hubbardston									
45. Cement City									
46. Eagle									
Total Functional Units	5	5	10	29	14	8	3	3	3
Location Coefficient	20	20	10	3.45	7.14	12.5	33.33	33.33	33.33

TABLE A.1.(CONTINUED)

Village	[D	[E	[F	[G	) A	) B	) C	% A	% B
1. Chelsea	5	1	1	2	1			1	
2. Lake Odessa	2			3			1	3	
3. Dexter	2		1	2	1			1	1
4. Fowlerville	2	1			1		3	1	
5. Nashville	3			1			1	1	
6. Manchester			1	3	1			1	1
7. Brooklyn	1		1	1	1		1	3	1
8. Bellevue	2			1			1		2
9. Homer	2			1	2				
10. Stockbridge	4						1	1	
11. Linden	1		2	2	1				
12. Grass Lake	2			1	1		1	1	
13. Pinckney								1	
14. Saranac	1		1		1				1
15. Ovid	2		1		1			1	
16. Webberville	1								
17. Fowler	1	1		1	1		2		
18. Parma			1		1				
19. Pewamo	1			1		1			
20. Springport	1	1			1				
21. Caledonia			1	1	1				
22. Addison					1		1		
23. Muir	1			1	1				
24. Concord			1				1	1	
25. Morrice	2								
26. Clarksville			1		1				
27. Vermontville	1			1	1				
28. Byron					1			2	
29. Lennon				2					
30. Dimondale	2			1	1				
31. Maple Rapids	1						1		
32. Sunfield	2				1		1		
33. Woodland	2				1				
34. Bancroft	1				1		1		
35. Muliken	1			1				1	
36. Westphalia	1			1	1			1	
37. Gaines									
38. Vernon									
39. Hanover	1				1				
40. Freeport									
41. Lyons				1			2	1	
42. Dansville				2					
43. Perrinton				1					
44. Hubbardston	1		1	1					
45. Cement City									
46. Eagle				1					
Total Functional Units	49	4	13	33	26	1	18	21	6
Location Coefficient	2.04	25	7.69	3.03	3.85	100	5.55	4.76	16.67

TABLE A.1. (CONTINUED)

Village	I A	I B	X	● A	● B	O A	O B	O C	h
1. Chelsea			1	1	1	2			1
2. Lake Odessa	1	1			1	1			1
3. Dexter	1	1					1		2
4. Fowlerville	1			1			3		2
5. Nashville				1			1		2
6. Manchester		1		1			1		1
7. Brooklyn	3		2				1		2
8. Bellevue							1		1
9. Homer				1	1		2		1
10. Stockbridge		1				1	1		1
11. Linden				1			1		1
12. Grass Lake							1		1
13. Pinckney		1				1	1	1	
14. Saranac			1	2			2		2
15. Ovid		1		1			1		2
16. Webberville				1					1
17. Fowler				1			2		
18. Parma									
19. Pewamo									
20. Springport			2			1			
21. Caledonia				1					
22. Addison		1				2			
23. Muir		1							
24. Concord							1		
25. Morrice									1
26. Clarksville							1		
27. Vermontville									1
28. Byron									
29. Lennon			1						
30. Dimondale				1			1		
31. Maple Rapids				1					
32. Sunfield		1							
33. Woodland			1						1
34. Bancroft									1
35. Muliken									1
36. Westphalia									
37. Gaines			1						
38. Vernon		1							
39. Hanover	1								
40. Freeport							2		
41. Lyons									1
42. Dansville				1			1		
43. Perrinton									
44. Hubbardston									
45. Cement City									
46. Eagle									
Total Functional Units	7	10	9	15	3	8	25	1	27
Location Coefficient	14.28	10	11.11	6.66	33.33	12.5	4	100	3.7

TABLE A.1. (CONTINUED)

Village	>	◆	▲ A	▲ B	▲ C	▲ D	▲ E	U A	U B
1. Chelsea		2		2					2
2. Lake Odessa		2	1	1		2			1
3. Dexter		1							1
4. Fowlerville		2						1	
5. Nashville	2	1						1	
6. Manchester		1		1			1		1
7. Brooklyn		1		1	1				
8. Bellevue		1				1			
9. Homer		1				1			
10. Stockbridge					1				1
11. Linden									1
12. Grass Lake								1	
13. Pinckney									
14. Saranac		1				1			1
15. Ovid				1					1
16. Webberville				1					
17. Fowler		1		1					
18. Parma		1							
19. Pewamo									
20. Springport				1					
21. Caledonia		1							
22. Addison									
23. Muir									
24. Concord									
25. Morrice									
26. Clarksville									
27. Vermontville									
28. Byron									
29. Lennon									
30. Dimondale						1			1
31. Maple Rapids									
32. Sunfield				1					
33. Woodland									
34. Bancroft									
35. Muliken									
36. Westphalia									
37. Gaines									
38. Vernon				1					
39. Hanover									
40. Freeport									
41. Lyons									
42. Dansville		1							
43. Perrinton									
44. Hubbardston									
45. Cement City									
46. Eagle									
Total Functional Units	2	17	1	11	2	6	1	3	10
Location Coefficient	50	5.88	100	9.09	50	16.67	100	33.33	10

TABLE A.1.(CONTINUED)

Village	= A	= B	= C	= D	Z A	Z B	Z C	Z D	Z E
1. Chelsea				1			3		
2. Lake Odessa	1	1		1			2		
3. Dexter				1			1		
4. Fowlerville				1			2		1
5. Nashville				1	1		2		
6. Manchester				1			2		
7. Brooklyn				1	1		1		
8. Bellevue		1					1	1	
9. Homer				1			2		
10. Stockbridge				1			1		
11. Linden			1				2		
12. Grass Lake				1			1		
13. Pinckney				1			1		
14. Saranac		1					2		
15. Ovid				1			1		
16. Webberville							1		
17. Fowler	2						1		
18. Parma				1			1		
19. Pewamo							1		
20. Springport	1			1			1		
21. Caledonia							1		
22. Addison							1		
23. Muir						1			
24. Concord			1				1		
25. Morrice							1		
26. Clarksville							1		
27. Vermontville				1			1		
28. Byron									
29. Lennon						1			
30. Dimondale				1			1		
31. Maple Rapids							1		
32. Sunfield				1			1		
33. Woodland			1				1		
34. Bancroft									
35. Muliken									
36. Westphalia							1		
37. Gaines						1			
38. Vernon									
39. Hanover							1		
40. Freeport			1				1		
41. Lyons									
42. Dansville									
43. Perrinton									
44. Hubbardston									
45. Cement City									
46. Eagle									
Total Functional Units	4	3	4	17	2	3	42	1	1
Location Coefficient	25	33.33	25	5.88	50	33.33	2.38	100	100

TABLE A.1. (CONTINUED)

Village	* A	* B	* C	P A	P B	P C	P D	P E	+ A
1. Chelsea	1	1	1		1				
2. Lake Odessa		1		2	2			1	
3. Dexter									
4. Fowlerville	2								
5. Nashville					1				2
6. Manchester	1								
7. Brooklyn					1				
8. Bellevue	1		2	1					
9. Homer	1		1						
10. Stockbridge	3	1			1		2		
11. Linden	1			1		1			
12. Grass Lake									
13. Pinckney	2								
14. Saranac	1			1	1				
15. Ovid					1			1	
16. Webberville			1						
17. Fowler	1								
18. Parma								2	
19. Pewamo	1		1	1					
20. Springport	1								
21. Caledonia	5			1	1	1			
22. Addison	1								
23. Muir						1			
24. Concord	1								
25. Morrice	2					1			
26. Clarksville	1						1		
27. Vermontville									
28. Byron	1				1				
29. Lennon									
30. Dimondale	1								
31. Maple Rapids	1								
32. Sunfield									
33. Woodland									
34. Bancroft									
35. Muliken	1						1		
36. Westphalia	2								
37. Gaines	1								
38. Vernon									
39. Hanover									
40. Freeport	1								
41. Lyons									
42. Dansville	1								
43. Perrinton	1								
44. Hubbardston	1								
45. Cement City	2								
46. Eagle									
Total Functional Units	39	3	6	7	10	4	4	4	2
Location Coefficient	2.56	33.33	16.67	14.28	10	25	25	25	50

TABLE A.1. (CONTINUED)

Village	⁺ B	⁺ C	⁺ D	S	■ A	■ B	■ C	■ D	■ E
1. Chelsea	1	1	2		2	2	2		1
2. Lake Odessa	2		2		1	2	1	1	
3. Dexter					1	1			
4. Fowlerville	1		1	1	1	2	1		
5. Nashville	1		1	1	1	1			
6. Manchester			2	1	1	1			
7. Brooklyn	1					2			
8. Bellevue			1			2			
9. Homer	1	1				2	1		
10. Stockbridge					1	1	2		
11. Linden	1	1				2			
12. Grass Lake					1	1		1	
13. Pinckney					1	1			
14. Saranac					1	2			
15. Ovid	1		2		1	2			
16. Webberville						2			
17. Fowler	1				1	1			
18. Parma					1				
19. Pewamo						1			
20. Springport					2		1		
21. Caledonia					1	1			
22. Addison					1				
23. Muir						2			
24. Concord					1				
25. Morrice						1			
26. Clarksville				1		1			
27. Vermontville					1	2			
28. Byron			1			1			
29. Lennon						1	1		
30. Dimondale						2			
31. Maple Rapids			1			1			
32. Sunfield					2				
33. Woodland						1			
34. Bancroft	1		1			1			
35. Muliken						2			
36. Westphalia					1	1			
37. Gaines						1			
38. Vernon				1		1			
39. Hanover					1	1	1		
40. Freeport						2			
41. Lyons						2			
42. Dansville					1				
43. Perrinton						1			
44. Hubbardston					1				
45. Cement City									
46. Eagle									
Total Functional Units	11	3	14	5	26	53	10	2	1
Location Coefficient	9.09	33.33	7.14	20	3.85	1.89	10	50	100

TABLE A.1. (CONTINUED)

Village	F	G	H	I	J	K	V A	V B	Auto- lundry
1. Chelsea	1					3	5		1
2. Lake Odessa					1		1		
3. Dexter						1		1	
4. Fowlerville						2	1	1	
5. Nashville								1	
6. Manchester			1		1	1		1	
7. Brooklyn		1			1	1			
8. Bellevue						1			
9. Homer					1	2	1	1	
10. Stockbridge			1			3	1		
11. Linden				1	2	1	1		
12. Grass Lake		1				1	1		
13. Pinckney							2		
14. Saranac			1				1		
15. Ovid								1	
16. Webberville							1		
17. Fowler				1		1			
18. Parma						2	3		
19. Pewamo									
20. Springport						1			
21. Caledonia				2					
22. Addison						1	1	1	
23. Muir									
24. Concord						1		1	
25. Morrice						1		1	
26. Clarksville							1		
27. Vermontville									
28. Byron					1	1	3	1	
29. Lennon						1			
30. Dimondale						2			
31. Maple Rapids		1				2			
32. Sunfield									
33. Woodland						1		1	
34. Bancroft							2		
35. Muliken									
36. Westphalia								1	
37. Gaines									
38. Vernon									
39. Hanover									
40. Freeport									
41. Lyons									
42. Dansville									
43. Perrinton									
44. Hubbardston									
45. Cement City									
46. Eagle									
Total Functional Units	1	3	3	4	7	30	25	12	1
Location Coefficient	100	33.33	33.33	25	14.28	3.33	4	8.33	100

TABLE A.1. (CONTINUED)

Village	Antiques	Photo	Bowling	Boats	Recreation	Functional Index
1. Chelsea		1			1	983.70
2. Lake Odessa						656.56
3. Dexter		1	1			484.14
4. Fowlerville						455.70
5. Nashville						453.91
6. Manchester			1			431.31
7. Brooklyn						389.24
8. Bellevue						384.09
9. Homer			1			379.18
10. Stockbridge						350.53
11. Linden						299.46
12. Grass Lake	1					298.86
13. Pinckney				1		291.56
14. Saranac						279.06
15. Ovid						251.88
16. Webberville						218.61
17. Fowler						206.96
18. Parma						195.46
19. Pewamo						192.19
20. Springport						187.18
21. Caledonia						174.53
22. Addison						153.12
23. Muir	1					145.26
24. Concord						132.51
25. Morrice						131.59
26. Clarksville						129.03
27. Vermontville						103.98
28. Byron						103.06
29. Lennon						100.81
30. Dimondale						90.86
31. Maple Rapids						87.67
32. Sunfield						83.22
33. Woodland						79.06
34. Bancroft						76.93
35. Muliken						73.80
36. Westphalia						69.36
37. Gaines						60.56
38. Vernon						60.42
39. Hanover						59.83
40. Freeport						55.21
41. Lyons						44.92
42. Dansville						37.00
43. Perrinton						26.51
44. Hubbardston						25.09
45. Cement City						22.70
46. Eagle						11.25
Total Functional Units	2	2	3	1	1	
Location Coefficient	50	50	33.33	100	100	

TABLE A.1*: Meaning of the Trade Symbols**

I. Food and Beverages

- A. P (Food Production)
 - PA - Produce company: Distributing, wholesale products and grocery
 - PB - Dairy products
 - PC - Dairy products and poultry
 - PD - Vegetables (onion, potatoes, mint, pickle)
 - PE - Fruits (fruit and confectionery, fruit and livestock, wholesale and retail sale: fruit)
- B. T (Grocery and Meat)
 - TA - Grocery and food market
 - TB - Meat
 - TC - Grocery and related (miscellaneous food stores)
 - TD - Farm grocery
- C. 11 (Elevator and Feed)
 - 11A- Elevator (grain, beans, soybeans)
 - 11B- Elevator (implements, fuel, feed, lumber)
 - 11C- Flour mill (mill company)
 - 11D- Flour and feed
 - 11E- Feed
- D. % (Bakery and Confectionery)
 - %A - Confectionery and related
 - %B - Bakery and related
- E. [(Eating and Drinking Places)
 - [A - Cider and vinegar
 - [B - billiards
 - [C - Beverages' dealers (wine, beer, liquor)
 - [D - Restaurant
 - [E - Hotel and miscellaneous
 - [F - Lunch and miscellaneous
 - [G - Tavern and miscellaneous

II. Textiles, Dress Shops and Apparel

- A. ▲ (Textiles and Dress Shops)
 - ▲ A - Yarn
 - ▲ B - Dry goods and wear (women and children)
 - ▲ C - Dress shop
 - ▲ D - Women's wear shop and furnishing
 - ▲ E - Millinery

*Dun and Bradstreet Reference Book, 1950.

**For better recognition of each individual function in 1950, the proper alphabetical order has been used in sub-divisions.

TABLE A.1: Cont

- B. +(Clothing)
 - +A - Clothing (cloth, shoes)
 - +B - Cleaners and dry cleaning
 - +C - Men, women and children wear and furnishings and shoes
 - +D - Men's wear, cloth and furnishing

- C. ● (Shoes)
 - A - Shoes and harness repair
 - B - Shoes

III. Chemicals, Drugs, Paints

- A. Z (Chemicals and Drugs)
 - ZA - Chemicals and allied products
 - ZB - Patent medicine
 - ZC - Drugs, and miscellaneous
 - ZD - Pharmacy (pharmaceutical preparations)
 - ZE - Remedies (hospital equipments)
- B. X (Paint)
 - X - Paint and wallpaper

IV. Construction Works and Wood Products

- A. O (Construction Works)
 - OA - Plumbing supply and plumbing
 - OB - Plumbing and heating
 - OC - Heating
- B.) (Wood Products)
 -)A - Funeral home and mortician
 -)B - Upholstering
 -)C - Furniture (used, gifts, repair)

V. Transportation Equipment

- A. C (Automobiles and Related)
 - CA - Filling station
 - CB - Service station
 - CC - Garage
 - CD - Oil and gas (distribution co.)
 - CE - Autobodies (body shop, repair, collision)
 - CF - Trucking
 - CG - Hauling
 - CH - Auto supply and auto parts (sales and service)
 - CI - Automobiles and tractors
 - CJ - Auto farm implements
 - CK - Trailers
 - CL - Bicycle

TABLE A.1: Cont

- B. S (Blacksmith and Related)
 - S - Blacksmith or horse and mule dealer

VI. Metal Products, Machinery and Electrical Products

- A. V (Metal Products)
 - VA - Machinery, machine shops and machinists supplies
 - VB - Welding & repair
- B. ■ (Machinery)
 - A - General hardware (hardware and implements)
 - B - Hardware stores (hardware and miscellaneous)
 - C - Farm machinery (appliances)
 - D - Tractors
 - E - Pumps
 - F - Household specialties
 - G - Household goods
 - H - House furnishing
 - I - Well driller (bowling and well drilling)
 - J - Sporting goods
 - K - Implements (agricultural)
- C. E (Electrical Products)
 - EA - Electrical supplies and equipments (sales, services and repair)
 - EB - Radio (sales, service or repair)
 - EC - Telephone Company and service

VII. General Merchandise Distribution

- A. * (General Stores)
 - * A - General store
 - * B - Department store
 - * C - General store and miscellaneous
- B. Λ (Variety stores)
 - Λ - Variety and gift shops

VIII. Other Businesses

- A. = (Book, Publishing, Printing)
 - = A - Books, bookbinders, newspapers
 - = B - Publishing
 - = C - Printing
 - = D - Publishing and printing
- B. U (Nurseries, Greenhouse)
 - UA - Nurseries (horticulture)
 - UB - Florist (greenhouse, flowers)

TABLE A.1: Cont

- C.  (Jewelry)
-  (Jewelry)
- D. | (Fuel, feed, food lockers, refrigerators)
 - |A - Fuel, coal, feed, etc.
 - |B - (Food lockers or wood, frozen food lockers, refrigerators)
- E. > (Music or Musical)
 - > - Violins (manufacturing and repair)

TABLE A.2. CENTRAL FUNCTIONS, LOCATION COEFFICIENTS AND FUNCTIONAL INDICES OF CENTRAL VILLAGES, 1970.

Village	5013	5014	5042	5043	5044	5045	5047	5048	5049
1. Chelsea	1							1	
2. Brooklyn	1			1			1		
3. Dexter									
4. Lake Odessa	1	1			1				
5. Ovid					1				
6. Homer		1		1					
7. Fowlerville						1			
8. Addison									
9. Manchester									
10. Saranac				1					
11. Pinckney									1
12. Caledonia				2					
13. Linden					1				
14. Stockbridge				2					
15. Nashville			1						
16. Concord									
17. Grass Lake									
18. Fowler									
19. Bellevue									
20. Parma							1		
21. Dimondale									
22. Woodland									
23. Byron									
24. Westphalia			1						
25. Vernon									
26. Muir									
27. Hanover							1		
28. Sunfield									
29. Maple Rapids									
30. Perrinton	1								
31. Springport									
32. Webberville									
33. Freeport									
34. Bancroft									
35. Lennon									
36. Cement City		1							
37. Vermontville									
38. Morrice									
39. Clarksville									
40. Pewamo									
41. Muliken									
42. Hubbardston									
43. Eagle									
44. Dansville									
45. Gaines									
46. Lyons									
Total Functional Units	4	3	2	7	3	1	3	1	1
Location Coefficient	25	33.33	50	14.29	33.33	100	33.33	100	100

Source: Author's collections based on Dun & Bradstreet Reference Book, 1970 and Telephone Directories, 1969 to 1971.

TABLE A.2. (CONTINUED)

[illegible]

TABLE A.2. (CONTINUED)

Village	5092	5093	5094	5095	5096	5098	5099	5211	5221
1. Chelsea	2				1			1	1
2. Brooklyn							3	1	1
3. Dexter				1		1		1	
4. Lake Odessa	2						1	2	
5. Ovid	1				1	1	1	1	
6. Homer	2	1					2	1	
7. Fowlerville					1		1	2	
8. Addison						1		2	
9. Manchester	1								
10. Saranac	1								
11. Pinckney							1	1	
12. Caledonia			1				2		
13. Linden						1		1	1
14. Stockbridge								2	
15. Nashville								2	
16. Concord							2	1	
17. Grass Lake						1	1	1	
18. Fowler	1						1	1	
19. Bellevue							1	1	
20. Parma							1	1	
21. Dimondale							1	2	
22. Woodland								1	
23. Byron	1							1	
24. Westphalia						1		2	
25. Vernon						1		1	1
26. Muir								1	
27. Hanover									
28. Sunfield									
29. Maple Rapids									
30. Perrinton									
31. Springport								2	
32. Webberville							1		
33. Freeport	1								
34. Bancroft								1	
35. Lennon								1	
36. Cement City									
37. Vermontville									
38. Morrice						1			
39. Clarksville									
40. Pewamo	1							1	
41. Muliken								1	
42. Hubbardston									
43. Eagle									
44. Dansville									
45. Gaines								1	
46. Lyons									
Total Functional Units	13	1	1	1	3	8	19	37	4
Location Coefficient	7.7	100	100	100	33.33	12.5	5.26	2.7	25

TABLE A.2. (CONTINUED)

Village	5231	5241	5251	5252	5311	5321	5331	5341	5399
1. Chelsea			1		1		1		1
2. Brooklyn		1	3	2	1		1		1
3. Dexter			1	2	1			1	
4. Lake Odessa			2	2					3
5. Ovid		1	3	1		1	1		
6. Homer			2	2	1		1		
7. Fowlerville			2	5					
8. Addison			1						
9. Manchester			2				1		2
10. Saranac			1	1					1
11. Pinckney			1						2
12. Caledonia			1	2					1
13. Linden			2						1
14. Stockbridge			1	2	2		1		
15. Nashville			1	3			1		1
16. Concord			1	1			1		
17. Grass Lake			1	1					3
18. Fowler			1	1			1		
19. Bellevue			2	2			1		1
20. Parma			1						
21. Dimondale			1						
22. Woodland				1			1		
23. Byron			2						1
24. Westphalia			1						
25. Vernon	1		1						
26. Muir			1						
27. Hanover			2						1
28. Sunfield			2						
29. Maple Rapids									
30. Perrinton			1						
31. Springport			1	2					
32. Webberville			1	2					2
33. Freeport			1						
34. Bancroft	1								
35. Lennon				1					1
36. Cement City									
37. Vermontville			1	1			1		
38. Morrice			1	1					
39. Clarksville			1						
40. Pewamo				1					
41. Muliken				1					1
42. Hubbardston			1						1
43. Eagle									
44. Dansville			1						
45. Gaines				3					
46. Lyons				1					
Total Functional Units	2	2	49	41	6	1	12	1	24
Location Coefficient	50	50	2.04	2.44	16.67	100	8.33	100	4.17

TABLE A.2. (CONTINUED)

Village	5411	5421	5441	5451	5462	5511	5521	5531	5541
1. Chelsea	5			1		5	1	1	8
2. Brooklyn	2	1				2		2	3
3. Dexter	8				1	1			5
4. Lake Odessa	4	1			1	2		3	3
5. Ovid	4					1	1		3
6. Homer	3	1				1			3
7. Fowlerville	2		1			2			3
8. Addison	2								3
9. Manchester	3				1	2			4
10. Saranac	2				1				4
11. Pinckney	4				1	1			3
12. Caledonia	3	1				2			2
13. Linden	1					2			4
14. Stockbridge			1	1		2			2
15. Nashville	4								3
16. Concord	2					1			3
17. Grass Lake	4					2			7
18. Fowler	2					1			3
19. Bellevue	4						1	1	2
20. Parma	2		1						
21. Dimondale	1								2
22. Woodland									1
23. Byron	2								2
24. Westphalia	1								1
25. Vernon									3
26. Muir	1							1	2
27. Hanover	1	1							2
28. Sunfield	2	1							
29. Maple Rapids	1								1
30. Perrinton	1								1
31. Springport	4								2
32. Webberville	2					1			
33. Freeport	1								1
34. Bancroft	2								
35. Lennon	1								
36. Cement City	1							1	1
37. Vermontville	3								3
38. Morrice	1								2
39. Clarksville	2								2
40. Pewamo	1								1
41. Muliken									1
42. Hubbardston									1
43. Eagle	1								1
44. Dansville	1								3
45. Gaines	1								1
46. Lyons	1								
Total Functional Units	93	6	3	2	5	28	3	9	102
Location Coefficient	1.08	16.67	33.33	50	20	3.57	33.33	11.11	.98

TABLE A.2.(CONTINUED)

Village	5591	5592	5599	5611	5621	5631	5651	5661	5699
1. Chelsea	1			2	2				
2. Brooklyn						1			
3. Dexter		1							
4. Lake Odessa									
5. Ovid			1	1	1				1
6. Homer		1			1		1	2	
7. Fowlerville				1					
8. Addison		2			1				
9. Manchester				1	1				
10. Saranac					1				
11. Pinckney	2				1				
12. Caledonia								2	
13. Linden									
14. Stockbridge					1				
15. Nashville	1	1							
16. Concord									
17. Grass Lake									
18. Fowler					1				
19. Bellevue							1		
20. Parma									
21. Dimondale	1	1							
22. Woodland									
23. Byron							1		
24. Westphalia									
25. Vernon									
26. Muir									
27. Hanover									
28. Sunfield									
29. Maple Rapids									
30. Perrinton									
31. Springport									
32. Webberville					1				
33. Freeport									
34. Bancroft									
35. Lennon									
36. Cement City									
37. Vermontville									
38. Morrice									
39. Clarksville							1		
40. Pewamo									
41. Muliken									
42. Hubbardston									
43. Eagle									
44. Dansville									
45. Gaines									
46. Lyons									
Total Functional Units	5	6	1	5	11	1	4	4	1
Location Coefficient	20	16.67	100	20	9.09	100	25	25	100

TABLE A.2.(CONTINUED)

Village	5712	5713	5714	5722	5732	5812	5813	5912	5921
1. Chelsea	1			1	1	3	4	2	1
2. Brooklyn			1		1	5	1	1	1
3. Dexter	1				1	1	2	2	
4. Lake Odessa					2	1	2	1	
5. Ovid	1						2	1	
6. Homer	1					2	2	2	1
7. Fowlerville	1							2	1
8. Addison					1	1	1	1	
9. Manchester				1	2	2	2	1	
10. Saranac	1				1	2	2	1	
11. Pinckney		1			2		1	1	
12. Caledonia						2		1	
13. Linden						1	1	2	
14. Stockbridge	1				1			1	
15. Nashville	1				1	1		1	
16. Concord	1					2	2		1
17. Grass Lake	1						1	1	
18. Fowler	1			1		1	2	1	
19. Bellevue	1					3		1	
20. Parma							1	1	
21. Dimondale						2	2		1
22. Woodland								1	
23. Byron								1	
24. Westphalia	1						2	1	
25. Vernon						1	1		
26. Muir	1				1				
27. Hanover					1	1			
28. Sunfield	1								
29. Maple Rapids							1		
30. Perrinton							1		1
31. Springport							1	1	
32. Webberville							1	1	
33. Freeport							1	1	
34. Bancroft							1		
35. Lennon							1		
36. Cement City						1	1		
37. Vermontville									
38. Morrice							1		
39. Clarksville								1	
40. Pewamo					1				
41. Muliken						1	2		
42. Hubbardston									
43. Eagle									
44. Dansville						1			
45. Gaines									
46. Lyons							1		
Total Functional Units	15	1	1	3	16	34	43	31	7
Location Coefficient	6.67	100	100	33.33	6.25	2.94	2.33	3.23	14.29

TABLE A.2. (CONTINUED)

Village	5932	5933	5952	5953	5962	5969	5971	5982	5983
1. Chelsea					1		1		
2. Brooklyn	1				2		1		
3. Dexter	1	1	1				1	1	
4. Lake Odessa			2	1	3	1	1		1
5. Ovid					2				1
6. Homer					1	1	1	1	1
7. Fowlerville					1	1		1	
8. Addison		1			1				
9. Manchester			1		1				
10. Saranac			1		1		1	1	
11. Pinckney			1						
12. Caledonia					1		1		
13. Linden									1
14. Stockbridge								1	
15. Nashville			1		2		1		
16. Concord						1			
17. Grass Lake			1		1				
18. Fowler			1		1				
19. Bellevue					2	1			
20. Parma	1				1				
21. Dimondale									
22. Woodland					2				
23. Byron									
24. Westphalia					1				
25. Vernon									
26. Muir									
27. Hanover					1				
28. Sunfield			1		1				
29. Maple Rapids									
30. Perrinton									
31. Springport					1				1
32. Webberville					1				1
33. Freeport									
34. Bancroft									
35. Lennon						1			
36. Cement City									
37. Vermontville					1				
38. Morrice					1		1		
39. Clarksville									
40. Pewamo					1				
41. Muliken									
42. Hubbardston									
43. Eagle									
44. Dansville									
45. Gaines									
46. Lyons									
Total Functional Units	3	2	10	1	31	6	9	5	6
Location Coefficient	33.33	50	10	100	3.23	16.67	11.11	20	16.67

TABLE A.2. (CONTINUED)

Village	5984	5992	5997	5999	7011	7216	7217	7261	7311
1. Chelsea				1				2	
2. Brooklyn		2	2	1		1		1	
3. Dexter			1	1		1		2	
4. Lake Odessa	1	1						1	
5. Ovid						1			
6. Homer		1		1					
7. Fowlerville						1			
8. Addison									
9. Manchester			1					1	
10. Saranac							1	1	1
11. Pinckney		1						1	
12. Caledonia								1	
13. Linden		1			1	1		1	
14. Stockbridge		1						1	
15. Nashville	1	1				1		1	
16. Concord		1						1	
17. Grass Lake			2					1	
18. Fowler								1	
19. Bellevue								1	
20. Parma				1					
21. Dimondale					1			1	
22. Woodland									
23. Byron								1	
24. Westphalia								1	
25. Vernon									
26. Muir									
27. Hanover									
28. Sunfield	1								
29. Maple Rapids								1	
30. Perrinton	1								
31. Springport									
32. Webberville									
33. Freeport									
34. Bancroft									
35. Lennon				1					
36. Cement City									
37. Vermontville								1	
38. Morrice									
39. Clarksville									
40. Pewamo									
41. Muliken								1	
42. Hubbardston									
43. Eagle			2						
44. Dansville								1	
45. Gaines								1	
46. Lyons									
Total Functional Units	4	9	8	6	2	6	1	25	1
Location Coefficient	25	11.11	12.5	16.67	50	16.67	100	4	100

TABLE A.2. (CONTINUED)

Village	7319	7394	7395	7399	7513	7531	7538	7542	7622
1. Chelsea							1		1
2. Brooklyn									1
3. Dexter			1					1	1
4. Lake Odessa									1
5. Ovid							1		
6. Homer									1
7. Fowlerville	1						1		
8. Addison					1		2		
9. Manchester									2
10. Saranac									
11. Pinckney									1
12. Caledonia									
13. Linden				1			1		
14. Stockbridge									1
15. Nashville									
16. Concord							1		
17. Grass Lake		1							
18. Fowler									
19. Bellevue							1		
20. Parma									
21. Dimondale									
22. Woodland				1		1			
23. Byron						1			
24. Westphalia									
25. Vernon									
26. Muir									
27. Hanover									1
28. Sunfield									
29. Maple Rapids							1		
30. Perrinton									
31. Springport									
32. Webberville									
33. Freeport							1		
34. Bancroft									
35. Lennon									
36. Cement City									
37. Vermontville									
38. Morrice									
39. Clarksville									
40. Pewamo									
41. Muliken									
42. Hubbardston							3		
43. Eagle									
44. Dansville									
45. Gaines									
46. Lyons									
Total Functional Units	1	1	1	2	1	2	13	1	10
Location Coefficient	100	100	100	50	100	50	7.7	100	10

TABLE A.2.(CONTINUED)

Village	7629	7631	7641	7692	7694	7699	7933	Attorney
1. Chelsea						3	1	3
2. Brooklyn				1			1	1
3. Dexter						4	1	3
4. Lake Odessa					1	2		
5. Ovid							1	
6. Homer							1	
7. Fowlerville		1				1		
8. Addison						1		1
9. Manchester		1		1				2
10. Saranac	1							
11. Pinckney							1	
12. Caledonia			1					
13. Linden								1
14. Stockbridge							1	1
15. Nashville								
16. Concord								1
17. Grass Lake								
18. Fowler	1					1	1	
19. Bellevue								
20. Parma								
21. Dimondale						1		
22. Woodland								
23. Byron								
24. Westphalia						1		
25. Vernon								
26. Muir					1			
27. Hanover								
28. Sunfield						1		
29. Maple Rapids								
30. Perrinton								
31. Springport						1		1
32. Webberville								
33. Freeport				1				
34. Bancroft								
35. Lennon						1		
36. Cement City								
37. Vermontville								1
38. Morrice								
39. Clarksville								
40. Pewamo								
41. Muliken								
42. Hubbardston								
43. Eagle								
44. Dansville								
45. Gaines								
46. Lyons								
Total Functional Units	2	2	1	3	2	17	8	15
Location Coefficient	50	50	100	33.33	50	5.88	12.5	6.67

TABLE A.2. (CONTINUED)

Village	Bank	Barber Shops	Church	Clinic	Dentist	Hospital
1. Chelsea	1	1	5	1	3	
2. Brooklyn	1		2			
3. Dexter	1	1	4		2	
4. Lake Odessa	1	2	5		2	
5. Ovid	1	1			1	
6. Homer	1	1	3		1	
7. Fowlerville	1		5		1	
8. Addison	2	2	7		2	1
9. Manchester	1	2	4		1	
10. Saranac	1	2	2		2	
11. Pinckney	1	1	3			
12. Caledonia	1	1	4		1	
13. Linden	1		2		1	
14. Stockbridge	1	2	2		1	
15. Nashville	1		4		1	
16. Concord	1		6			
17. Grass Lake	1	1	3			
18. Fowler	1					
19. Bellevue	1	1	4		1	
20. Parma	1					
21. Dimondale	1		2			
22. Woodland			1			
23. Byron	1	1	2			
24. Westphalia	1	1	1			
25. Vernon	1		1			
26. Muir	1					
27. Hanover						
28. Sunfield	1		3			
29. Maple Rapids	1					
30. Perrinton	1		1			
31. Springport	1	1	1		1	
32. Webberville	1		1			
33. Freeport			2			
34. Bancroft			2			
35. Lennon						
36. Cement City						
37. Vermontville			2			
38. Morrice	1	1				
39. Clarksville	1		1			
40. Pewamo	1					
41. Muliken						
42. Hubbardston	1					
43. Eagle						
44. Dansville			2			
45. Gaines			1			
46. Lyons	1		1			
Total Functional Units	36	22	89	1	21	1
Location Coefficient	2.78	4.54	1.12	100	4.76	100

TABLE A.2. (CONTINUED)

Village	Optome- trist	Doctors Offices	Schools	Veterinerians	Functional Index
1. Chelsea		7	4		884.66
2. Brooklyn	1	1	2	1	880.19
3. Dexter		1	4		792.87
4. Lake Odessa		1	3	1	675.66
5. Ovid			4	1	634.81
6. Homer			1	1	633.15
7. Fowlerville		2	2	1	604.84
8. Addison		3	2	1	517.26
9. Manchester		1	3		425.60
10. Saranac		1	3		421.12
11. Pinckney		1	4		382.30
12. Caledonia		1	5		381.93
13. Linden		1	5	1	296.06
14. Stockbridge		1	4		291.07
15. Nashville			3		239.74
16. Concord			1		237.17
17. Grass Lake			4	1	232.12
18. Fowler		1	3		206.40
19. Bellevue		2	1		183.42
20. Parma			3		157.77
21. Dimondale			1		143.17
22. Woodland					125.26
23. Byron			3		117.65
24. Westphalia			3		111.20
25. Vernon			1		105.38
26. Muir		1	2		90.22
27. Hanover		1			87.28
28. Sunfield		1	1		84.43
29. Maple Rapids	1		2	1	80.02
30. Perrinton			4		78.74
31. Springport		1	4		77.50
32. Webberville			2		66.76
33. Freeport			1		61.66
34. Bancroft			1		60.46
35. Lennon					51.94
36. Cement City					51.77
37. Vermontville			1		50.45
38. Morrice			3		47.10
39. Clarksville			1		39.32
40. Pewamo			2	1	38.31
41. Muliken			1		37.21
42. Hubbardston			2		35.13
43. Eagle					27.06
44. Dansville				1	24.33
45. Gaines			1		18.23
46. Lyons					9.75
Total Functional Units	2	28	97	11	
Location Coefficient	50	3.57	1.03	9.09	

TABLE A.2: Meaning of SIC (Standard Industrial Classification) Numbers

1. Wholesale Trade

- 5013 - Automotive equipment
- 5014 - Tires and tubes
- 5042 - Frozen foods
- 5043 - Dairy products
- 5044 - Poultry and poultry products
- 5045 - Confectionery
- 5047 - Meals and meat products
- 5048 - Fresh fruits and vegetables
- 5049 - Groceries and related products, n.e.c.**
- 5053 - Grain (elevator company)
- 5054 - Livestock
- 5072 - Hardware
- 5074 - Plumbing & heating equipment and supplies
- 5082 - Construction and mining machinery and equipment
- 5083 - Farm machinery and equipment
- 5084 - Industrial machinery and equipment
- 5085 - Industrial supplies
- 5086 - Professional equipment and supplies
- 5092 - Petroleum and petroleum products
- 5093 - Scrap and waste materials
- 5094 - Tobacco and its products
- 5095 - Beer, wine, and distilled alcoholic beverages
- 5096 - Paper and its products
- 5098 - Lumber and construction materials
- 5099 - Wholesalers, n.e.c.

2. Retail Trade

- A. Building Materials, Hardware and Farm Equipment
 - 5211 - Lumber and other building materials dealers
 - 5221 - Plumbing, heating and air conditioning equipment dealers
 - 5231 - Paint, glass and wallpaper stores
 - 5241 - Electrical supply stores
 - 5251 - Hardware stores
 - 5252 - Farm equipment dealers
- B. General Merchandise
 - 5311 - Department stores
 - 5321 - Mail order houses
 - 5331 - Variety stores
 - 5341 - Automatic merchandising, machine operators
 - 4399 - Miscellaneous general merchandise stores

*Dun and Bradstreet Reference Book 1970.

** Not elsewhere classified indicated by n.e.c.

TABLE A.2: CONT

- C. Food
 - 5411 - Grocery Stores
 - 5421 - Meat and fish (seafood) market
 - 5441 - Candy, nuts and confectionery stores
 - 5451 - Dairy products stores
 - 5461 - Retail bakeries, baking and selling
- D. Automotive Dealers and Gasoline Service Stations
 - 5511 - Motor vehicle dealers (new and used cars)
 - 5521 - Motor vehicle dealers (used cars only)
 - 5531 - Tire, battery and accessory dealers
 - 5541 - Gasoline service stations
 - 5591 - Boat dealers
 - 5592 - Household trailer dealers
 - 5599 - Aircraft and automotive dealers, n.e.c.
- E. Apparel and Accessories
 - 5611 - Men's and boys' clothing and furnishing stores
 - 5621 - Women's ready-to-wear stores
 - 5631 - Women's accessory and specialty stores
 - 5651 - Family clothing stores
 - 5661 - Shoe stores
 - 5699 - Miscellaneous apparel and accessory stores
- F. Furniture, Home Furnishings and Equipment
 - 5712 - Furniture Stores
 - 5713 - Floor covering stores
 - 5714 - Drapery, curtain and upholstery stores
 - 5722 - Household appliance stores
 - 5732 - Radio and television stores
- G. Eating and Drinking Places
 - 5812 - Eating places
 - 5813 - Drinking places (alcoholic beverages)
- H. Miscellaneous Retail Stores
 - 5912 - Drug store and proprietary stores
 - 5921 - Liquor stores
 - 5932 - Antique stores
 - 5933 - Second hand stores
 - 5952 - Sporting goods stores
 - 5953 - Bicycle shops
 - 5962 - Hay, grain, and feed stores
 - 5969 - Farm and garden supply stores, n.e.c.
 - 5971 - Jewelry stores
 - 5982 - Fuel and ice dealers, except fuel oil dealers and bottled gas dealers
 - 5983 - Fuel oil dealers
 - 5984 - Liquified petroleum gas (bottled gas) dealers
 - 5992 - Florists
 - 5997 - Gift, novelty and souvenir shops (gift shops)
 - 5999 - Miscellaneous retail stores, n.e.c.

TABLE A.2: Cont

3. Services

- A. Hotels, Rooming Houses, Camps and Other Lodging Places
 - 7011 - Hotels, tourist courts, and motels
 - B. Personal Services
 - 7216 - Dry cleaning and dyeing plants, except rug cleaning
 - 7217 - Rug cleaning and repairing plants
 - 7261 - Funeral service and crematories
 - C. Miscellaneous Business Services
 - 7311 - Advertising agencies
 - 7319 - Miscellaneous advertising
 - 7394 - Equipment rental and leasing services
 - 7395 - Photofinishing laboratories
 - 7399 - Business services, n.e.c.
 - D. Automotive Repair, Automobile Services, and Garages
 - 7513 - Truck rental and leasing, without drivers
 - 7531 - Top and body repair shops
 - 7538 - General automobile repair shops
 - 7542 - Automobile laundries
 - E. Miscellaneous Repair Services
 - 7622 - Radio and television repair shops
 - 7629 - Electrical repair shops
 - 7631 - Watch, clock and jewelry repair
 - 7641 - Re-upholstery and furniture repair
 - 7692 - Welding repair
 - 7694 - Armature rewinding shops
 - 7699 - Repair shops and related services, n.e.c.
 - F. Amusement and Recreation Services, Except Motion Pictures
 - 7933 - Bowling Alleys
-

TABLE A.3. CENTRAL FUNCTIONS, LOCATION COEFFICIENTS AND FUNCTIONAL INDICES OF CENTRAL VILLAGES, 1980.

Village	5013	5021	5031	5039	5041	5051	5074	5083	5084
1. Brooklyn	2							2	
2. Dexter		1		1				2	
3. Chelsea	1					1			1
4. Fowlerville	1							2	
5. Saranac					1				
6. Manchester			1	1			1	1	
7. Linden				1					
8. Pinckney									
9. Homer					1			1	
10. Addison				1					
11. Stockbridge	1								
12. Grass Lake				1					
13. Ovid				1				2	
14. Lake Odessa	2							1	
15. Bellevue								1	
16. Hanover									
17. Nashville								2	
18. Fowler	1							2	
19. Dimondale					1				
20. Sunfield			1						
21. Caledonia	1							2	
22. Webberville								1	
23. Cement City									
24. Lennon								1	
25. Concord									
26. Parma									
27. Westphalia									
28. Morrice			1					1	
29. Vermontville									
30. Byron									
31. Muir									
32. Perrinton	1								
33. Freeport									
34. Bancroft									
35. Vernon			1						
36. Lyons									
37. Maple Rapids									
38. Pewamo								1	
39. Springport								1	
40. Muliken									
41. Woodland								1	
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines								1	
46. Dansville									
Total Functional Units	10	1	4	6	3	1	1	25	1
Location Coefficient	10	100	25	16.66	33.33	100	100	4	100

Source: Author's collections based on Dun & Bradstreet Reference Book, 1980 and Telephone Directories, 1979-1982.

TABLE A.3. (CONTINUED)

Village	5085	5086	5087	5088	5099	5112	5113	5141	5143
1. Brooklyn			1		3				
2. Dexter	1				2				
3. Chelsea	2								
4. Fowlerville	1								
5. Saranac						1			
6. Manchester									
7. Linden					1			1	
8. Pinckney									
9. Homer					1			1	
10. Addison									1
11. Stockbridge									
12. Grass Lake	1								
13. Ovid							1		
14. Lake Odessa									
15. Bellevue									
16. Hanover									
17. Nashville									
18. Fowler									
19. Dimondale									
20. Sunfield									
21. Caledonia									
22. Webberville				1					
23. Cement City									
24. Lennon		1							
25. Concord					1				
26. Parma									
27. Westphalia									
28. Morrice									
29. Vermontville		1							
30. Byron									
31. Muir									
32. Perrinton									
33. Freeport									
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo									
39. Springport									
40. Muliken									
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	5	2	1	1	8	1	1	2	1
Location Coefficient	20	50	100	100	12.5	100	100	50	100

TABLE A.3.(CONTINUED)

Village	5144	5147	5149	5153	5154	5159	5171	5172	5181
1. Brooklyn						1		1	
2. Dexter									1
3. Chelsea				1				2	
4. Fowlerville				1					
5. Saranac	2			1			2	1	
6. Manchester				1	1			1	
7. Linden									
8. Pinckney		1							
9. Homer		1		1					
10. Addison								1	
11. Stockbridge									
12. Grass Lake									
13. Ovid				2					
14. Lake Odessa				2				1	
15. Bellevue				1					
16. Hanover				1					
17. Nashville							1		
18. Fowler				1					
19. Dimondale									
20. Sunfield				2					
21. Caledonia									
22. Webberville				1					
23. Cement City			1						
24. Lennon									
25. Concord				1					
26. Parma									
27. Westphalia				1					
28. Morrice				1					
29. Vermontville				1					
30. Byron							1		
31. Muir									
32. Perrinton									
33. Freeport								1	
34. Bancroft							1		
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo				1					
39. Springport									
40. Muliken				1					
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	2	2	1	21	1	1	5	8	1
Location Coefficient	50	50	100	4.76	100	100	20	12.5	100

TABLE A.3.(CONTINUED)

Village	5191	5199	5211	5231	5251	5261	5271	5311	5331
1. Brooklyn		2	1		1				2
2. Dexter			2		1	2		1	
3. Chelsea	1	1	1	1	2			1	1
4. Fowlerville	1		2		3				
5. Saranac	1				1				
6. Manchester		1			2				1
7. Linden		1	3		2				
8. Pinckney			1	1	2	1			1
9. Homer	1		1		2		1		
10. Addison	1		1		1				
11. Stockbridge	1	1	1		1			1	1
12. Grass Lake		3	2						
13. Ovid	3		1		3				1
14. Lake Odessa	2		1		2				
15. Bellevue			1		2	1			
16. Hanover	1				3				
17. Nashville	1	1	2		1				2
18. Fowler	1		1		1				1
19. Dimondale							2		
20. Sunfield					1	1			
21. Caledonia	2			1	1				
22. Webberville					1				
23. Cement City									
24. Lennon			1			1	2		
25. Concord			1		1				1
26. Parma		1	1						
27. Westphalia					1				
28. Morrice					1				
29. Vermontville					1				
30. Byron		1	2		1				
31. Muir					1				
32. Perrinton	1				1	1			
33. Freeport	1	2			2				
34. Bancroft				1					
35. Vernon		1			2				
36. Lyons									
37. Maple Rapids					1				
38. Pewamo									
39. Springport	1				2				
40. Muliken	1		1						
41. Woodland	1		2						
42. Eagle									
43. Clarksville		1	1						
44. Hubbardston					1				
45. Gaines			1						
46. Dansville									
Total Functional Units	21	16	31	4	48	7	5	3	11
Location Coefficient	4.76	6.25	3.22	25	2.08	14.28	20	33.33	9.09

TABLE A.3. (CONTINUED)

Village	5399	5411	5422	5423	5431	5441	5462	5499	5511
1. Brooklyn	1	2							2
2. Dexter		2					1		1
3. Chelsea		7							5
4. Fowlerville		6				1		1	3
5. Saranac	1	1		1					
6. Manchester	1	2							2
7. Linden	1	3				1			1
8. Pinckney		3							1
9. Homer		2							1
10. Addison	1	2							
11. Stockbridge		2							2
12. Grass Lake	2	2							2
13. Ovid		2							1
14. Lake Odessa		1							2
15. Bellevue		2			1				
16. Hanover	1	2		1					
17. Nashville		1							1
18. Fowler		3							
19. Dimondale		2							
20. Sunfield			1						
21. Caledonia	2	2							2
22. Webberville		1							1
23. Cement City		2							1
24. Lennon		1							
25. Concord		1							1
26. Parma		4		1					
27. Westphalia		1							
28. Morrice		2							
29. Vermontville									
30. Byron									
31. Muir									
32. Perrinton									
33. Freeport									
34. Bancroft		1							
35. Vernon		1							
36. Lyons									
37. Maple Rapids		1							
38. Pewamo	1								
39. Springport		1							1
40. Muliken	1								
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston	1								
45. Gaines									
46. Dansville									
Total Functional Units	13	65	1	3	1	2	1	1	30
Location Coefficient	7.69	1.54	100	33.33	100	50	100	100	3.33

TABLE A.3.(CONTINUED)

Village	5521	5531	5541	5551	5561	5571	5599	5611	5621
1. Brooklyn			2	2	1	1		1	1
2. Dexter			2						1
3. Chelsea		2	4					1	2
4. Fowlerville			3					1	1
5. Saranac			3						1
6. Manchester			1					2	
7. Linden	1	1	2						1
8. Pinckney			1	2					
9. Homer	1	2	1						1
10. Addison			1						1
11. Stockbridge			1						1
12. Grass Lake		2	1			1			
13. Ovid			1					1	1
14. Lake Odessa		1		1					
15. Bellevue	1								
16. Hanover			2						
17. Nashville		1			1		1		
18. Fowler			1						1
19. Dimondale			1	1					
20. Sunfield									
21. Caledonia			2						
22. Webberville			1						
23. Cement City		1	1	1					
24. Lennon									
25. Concord		1	1						
26. Parma									
27. Westphalia			1						
28. Morrice							1		
29. Vermontville									
30. Byron									
31. Muir			1						
32. Perrinton									
33. Freeport									
34. Bancroft			1						
35. Vernon									
36. Lyons						1			
37. Maple Rapids									
38. Pewamo									
39. Springport			1						
40. Muliken									
41. Woodland									
42. Eagle			1						
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville			1						
Total Functional Units	3	11	38	7	2	3	2	6	12
Location Coefficient	33.33	9.09	2.63	14.28	50	33.33	50	16.66	8.33

TABLE A.3. (CONTINUED)

Village	5641	5651	5661	5699	5712	5713	5714	5719	5722
1. Brooklyn						2	1	1	
2. Dexter					2				
3. Chelsea					3				1
4. Fowlerville					2				
5. Saranac									
6. Manchester									
7. Linden									
8. Pinckney						3			
9. Homer		1			1				
10. Addison									
11. Stockbridge									
12. Grass Lake					1				
13. Ovid				1	1				
14. Lake Odessa		2							
15. Bellevue		1						1	
16. Hanover				1					
17. Nashville		1			1				
18. Fowler	1				1				
19. Dimondale									
20. Sunfield					1				
21. Caledonia									
22. Webberville									
23. Cement City								2	
24. Lennon								1	
25. Concord					1				1
26. Parma						1			
27. Westphalia			1						
28. Morrice									
29. Vermontville									
30. Byron									
31. Muir									
32. Perrinton									
33. Freeport									
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo									
39. Springport									
40. Muliken									
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	1	5	1	2	14	6	1	5	2
Location Coefficient	100	20	100	50	7.14	16.66	100	20	50

TABLE A.3. (CONTINUED)

Village	5732	5733	5812	5813	5912	5921	5931	5941	5944
1. Brooklyn	1		3	2	3	1		3	3
2. Dexter			2		3	3	1	1	
3. Chelsea	1		4	2	2				1
4. Fowlerville			4	3	1				1
5. Saranac	1				1				
6. Manchester	1		3		1				
7. Linden	2		1		2	1			1
8. Pinckney			1	2	2			4	
9. Homer							1		
10. Addison				1		1		1	
11. Stockbridge	2	2	1			2		1	
12. Grass Lake				2		1			
13. Ovid			2		1	1			
14. Lake Odessa	1		1		1			1	1
15. Bellevue			1	2	1				
16. Hanover	1		1	1					
17. Nashville			1	1	1				
18. Fowler			1	1	1				
19. Dimondale			1						
20. Sunfield								1	
21. Caledonia			3						
22. Webberville				2	1		1		
23. Cement City									
24. Lennon					1				
25. Concord			3	1					
26. Parma			1	2		1	1		
27. Westphalia									
28. Morrice									
29. Vermontville								1	
30. Byron									
31. Muir									
32. Perrinton									
33. Freeport			1						
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids				2					
38. Pewamo	1			1					
39. Springport			1	1					
40. Muliken									
41. Woodland								1	
42. Eagle				1					
43. Clarksville				1					
44. Hubbardston				2					
45. Gaines								1	
46. Dansville									
Total Functional Units	11	2	36	30	22	11	4	15	7
Location Coefficient	9.09	50	2.77	3.33	4.54	9.09	25	6.66	14.28

TABLE A.3. (CONTINUED)

Village	5945	5947	5949	5961	5982	5983	5984	5992	5993
1. Brooklyn		2						2	4
2. Dexter		1						1	
3. Chelsea		2	1					1	
4. Fowlerville			1						
5. Saranac									
6. Manchester		1						1	
7. Linden	1	1				1	1		
8. Pinckney		2	1	1			1		
9. Homer					1	1		1	
10. Addison	1							1	
11. Stockbridge								1	
12. Grass Lake						1		1	
13. Ovid						1			
14. Lake Odessa									
15. Bellevue								1	
16. Hanover								1	
17. Nashville									
18. Fowler		1				1			
19. Dimondale							1		
20. Sunfield									
21. Caledonia			1			1			
22. Webberville						1			
23. Cement City									
24. Lennon			1						
25. Concord								1	
26. Parma								1	1
27. Westphalia			1					1	
28. Morrice								1	
29. Vermontville									
30. Byron									
31. Muir									
32. Perrinton		1					1		
33. Freeport									
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo									
39. Springport									
40. Muliken									
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	2	11	6	1	1	7	4	15	5
Location Coefficient	50	9.09	16.66	100	100	14.28	25	6.66	20

TABLE A.3. (CONTINUED)

Village	5999	7011	7211	7216	7217	7261	7299	7311	7312
1. Brooklyn									1
2. Dexter			1			1			
3. Chelsea						1			
4. Fowlerville						1			
5. Saranac					1	1		1	
6. Manchester									
7. Linden	2								
8. Pinckney									
9. Homer									
10. Addison							1		
11. Stockbridge		1				1			
12. Grass Lake	1					1		1	
13. Ovid									
14. Lake Odessa				1					
15. Bellevue									
16. Hanover									
17. Nashville	1								
18. Fowler									
19. Dimondale		1							
20. Sunfield									
21. Caledonia						1			
22. Webberville									
23. Cement City									
24. Lennon									
25. Concord									
26. Parma									
27. Westphalia									
28. Morrice									
29. Vermontville									
30. Byron									
31. Muir						1			
32. Perrinton									
33. Freeport						1			
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo									
39. Springport									
40. Muliken									
41. Woodland									
42. Eagle									
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	4	2	1	1	1	9	1	2	1
Location Coefficient	25	50	100	100	100	11.11	100	50	100

TABLE A.3. (CONTINUED)

Village	7374	7394	7513	7538	7542	7622	7623	7629	7641
1. Brooklyn				1					
2. Dexter				1	1			1	
3. Chelsea	3			1					
4. Fowlerville	1	1				1			
5. Saranac									
6. Manchester									
7. Linden						3			
8. Pinckney							1		1
9. Homer				1					
10. Addison			1					1	1
11. Stockbridge				1					1
12. Grass Lake						1			
13. Ovid						1			
14. Lake Odessa									
15. Bellevue							1		1
16. Hanover			1					1	
17. Nashville									
18. Fowler									
19. Dimondale				1					
20. Sunfield		1							
21. Caledonia									
22. Webberville									
23. Cement City									
24. Lennon									
25. Concord									
26. Parma									
27. Westphalia									
28. Morrice									
29. Vermontville				2					
30. Byron							1		
31. Muir						1			
32. Perrinton									
33. Freeport									
34. Bancroft									
35. Vernon									
36. Lyons									
37. Maple Rapids									
38. Pewamo									
39. Springport									
40. Muliken									
41. Woodland									
42. Eagle				1					
43. Clarksville									
44. Hubbardston									
45. Gaines									
46. Dansville									
Total Functional Units	4	2	2	9	1	7	3	3	4
Location Coefficient	25	50	50	11.11	100	14.28	33.33	33.33	25

TABLE A.3. (CONTINUED)

Village	7692	7694	7699	7933	8911	Attorney	Bank	Barber Shop
1. Brooklyn				1		1	3	2
2. Dexter			1			4	1	
3. Chelsea				1		6	4	3
4. Fowlerville			1			3	1	1
5. Saranac							1	2
6. Manchester	1					3	2	1
7. Linden						1	2	2
8. Pinckney						1	2	
9. Homer							1	1
10. Addison						1	1	1
11. Stockbridge						1	1	2
12. Grass Lake					2		1	3
13. Ovid			1	1		1	1	1
14. Lake Odessa			1			1	2	3
15. Bellevue							1	2
16. Hanover		1					2	1
17. Nashville						1	1	
18. Fowler			1	1			1	
19. Dimondale					1		1	
20. Sunfield							1	
21. Caledonia			1			2	2	
22. Webberville						2	1	
23. Cement City								
24. Lennon								
25. Concord						1	1	
26. Parma							1	
27. Westphalia						1	1	
28. Morrice			1				1	1
29. Vermontville							1	
30. Byron			1					
31. Muir		1						
32. Perrinton							1	
33. Freeport							1	
34. Bancroft								
35. Vernon							1	
36. Lyons						1		1
37. Maple Rapids							1	
38. Pewamo							1	
39. Springport							1	
40. Muliken			1					
41. Woodland							1	
42. Eagle								
43. Clarksville							1	
44. Hubbardston								
45. Gaines								
46. Dansville						1	1	
Total Functional Units	1	2	9	4	3	32	47	27
Location Coefficient	100	50	11.11	25	33.33	3.12	2.13	3.70

TABLE A.3. (CONTINUED)

Village	Church	Clinic	Dentist	Hospital	Optome- trist	Doctor's Office
1. Brooklyn	7		1		1	
2. Dexter	8	2	5			7
3. Chelsea	17	2	4	1	1	22
4. Fowlerville	7		3		1	2
5. Saranac	3	1	1			1
6. Manchester	12		2			5
7. Linden	12	1	2			3
8. Pinckney	5		2			1
9. Homer	6		1		1	
10. Addison	2					1
11. Stockbridge	5		1		1	1
12. Grass Lake	7					1
13. Ovid	7		1			4
14. Lake Odessa	8	1	3		2	3
15. Bellevue	6		1			1
16. Hanover	2		2			2
17. Nashville	8		1			
18. Fowler	3					3
19. Dimondale	4					
20. Sunfield	4					1
21. Caledonia	11		2		1	
22. Webberville	3		1			
23. Cement City	2					
24. Lennon	2					
25. Concord	4	1				1
26. Parma	4					1
27. Westphalia	3					1
28. Morrice	1					
29. Vermontville	2					1
30. Byron	3		1			
31. Muir						1
32. Perrinton	1					
33. Freeport	3					
34. Bancroft	4					
35. Vernon	4					
36. Lyons	1					
37. Maple Rapids	1		1		1	1
38. Pewamo						
39. Springport	2		1			
40. Muliken						
41. Woodland	4					
42. Eagle						
43. Clarksville	3					
44. Hubbardston						
45. Gaines	3					
46. Dansville	1					
Total Functional Units	195	8	36	1	9	64
Location Coefficient	.51	12.5	2.77	100	11.11	1.56

TABLE A.3.(CONTINUED)

Village	School	Veterinerian	Functional Index
1. Brooklyn	2	1	1,024.45
2. Dexter	4	1	1,012.23
3. Chelsea	6	3	986.53
4. Fowlerville	3	8	615.25
5. Saranac	3		563.19
6. Manchester	2	2	519.41
7. Linden	2	1	515.13
8. Pinckney	2	2	484.33
9. Homer	2		465.47
10. Addison	1		458.00
11. Stockbridge	3	1	377.21
12. Grass Lake	1	1	374.92
13. Ovid	2	1	369.57
14. Lake Odessa	3	1	360.68
15. Bellevue	2		305.61
16. Hanover	2		290.84
17. Nashville	2		257.45
18. Fowler	2	1	249.11
19. Dimondale		2	225.94
20. Sunfield	1		221.86
21. Caledonia	4	1	188.13
22. Webberville	2	1	187.51
23. Cement City			173.43
24. Lennon	1		152.17
25. Concord	2	1	151.05
26. Parma	2		144.43
27. Westphalia	1		144.12
28. Morrice	1		114.48
29. Vermontville	2		93.33
30. Byron	2		86.41
31. Muir			81.66
32. Perrinton	1		69.30
33. Freeport			51.46
34. Bancroft			51.21
35. Vernon			41.12
36. Lyons			40.66
37. Maple Rapids		1	36.02
38. Pewamo	1	1	35.57
39. Springport	2		35.34
40. Muliken		1	34.66
41. Woodland	1		27.48
42. Eagle			17.07
43. Clarksville			16.46
44. Hubbardston			16.43
45. Gaines			15.41
46. Dansville	2	1	14.41
Total Functional Units	69	32	
Location Coefficient	1.45	3.12	

TABLE A.3: Meaning of SIC (Standard Industrial Classification) Numbers

1. Wholesale Trade

A. Durable Goods

- 5013 - Automotive parts and supplies
- 5021 - Tires and tubes
- 5031 - Lumber, plywood and millwork
- 5039 - Construction materials, n.e.c.**
- 5041 - Sporting and recreational goods and supplies
- 5051 - Metal service centers and offices
- 5074 - Plumbing and heating equipment and supplies (hydronics)
- 5083 - Farm and garden machinery and equipment
- 5084 - Industrial machinery and equipment
- 5085 - Industrial supplies
- 5086 - Professional equipment and supplies
- 5087 - Service establishment equipment and supplies
- 5088 - Transportation equipment and supplies, except motor vehicles
- 5099 - Durable goods, n.e.c.

B. Nondurable Goods

- 5112 - Stationery supplies
- 5113 - Industrial and personal service paper
- 5141 - Groceries, general line
- 5143 - Dairy products
- 5144 - Poultry and poultry products
- 5147 - Confectionery
- 5149 - Groceries and related products, n.e.c.
- 5153 - Grain (elevator company)
- 5154 - Livestock
- 5159 - Farm product raw materials, n.e.c.
- 5171 - Petroleum bulk stations and terminals
- 5172 - Petroleum and petroleum products wholesalers, except bulk stations and terminals
- 5181 - Beer and ale
- 5191 - Farm supplies
- 5199 - Nondurable goods, n.e.c.

*Dun and Bradstreet Reference Book, 1980.

**Not elsewhere classified indicated by n.e.c.

TABLE A.3: Cont:

2. Retail Trade

- A. Building Materials, Hardware, Garden Supply, and Mobile Home Dealers
 - 5211 - Lumber and other building materials dealers
 - 5231 - Paint, glass and wallpaper stores
 - 5251 - Hardware stores
 - 5261 - Retail nurseries, lawn and garden supplies stores
 - 5271 - Mobile home dealers
- B. General Merchandise Stores
 - 5311 - Department stores
 - 5331 - Variety stores
 - 5399 - Miscellaneous general merchandise stores
- C. Food Stores
 - 5411 - Grocery stores
 - 5422 - Freezer & locker meat provisions
 - 5423 - Meat and fish (seafood) markets
 - 5431 - Fruit stores and vegetable markets
 - 5441 - Candy, nut and confectionery stores
 - 5462 - Retail bakeries, baking and selling
 - 5499 - Miscellaneous food stores
- D. Automotive Dealers and Gasoline Service Stations
 - 5511 - Motor vehicle dealers (new and used)
 - 5521 - Motor vehicle dealers (used only)
 - 5531 - Auto and home supply stores
 - 5541 - Gasoline service stations
 - 5551 - Boat dealers
 - 5561 - Recreational and utility trailer dealers
 - 5571 - Motorcycle dealers
 - 5599 - Automotive dealers, n.e.c.
- E. Apparel and Accessory Stores
 - 5611 - Men's and boys' clothing and furnishings stores
 - 5621 - Women's ready-to-wear stores
 - 5641 - Children's and infant's wear stores
 - 5651 - Family clothing stores
 - 5661 - Shoe stores
 - 5699 - Miscellaneous apparel and accessory stores
- F. Furniture, Home Furnishings and Equipment Stores
 - 5712 - Furniture stores
 - 5713 - Floor covering stores
 - 5714 - Drapery, curtain and upholstery stores
 - 5719 - Miscellaneous home furnishing stores
 - 5722 - Household appliance stores
 - 5732 - Radio and television stores
 - 5733 - Music stores

TABLE A.3: Cont

- G. Eating and Drinking Places
 - 5812 - Eating Places
 - 5813 - Drinking places (alcoholic beverages)
- H. Miscellaneous Retail
 - 5912 - Drug stores and proprietary stores
 - 5921 - Liquor stores
 - 5931 - Used merchandise stores
 - 5941 - Sporting goods stores and bicycle shops
 - 5944 - Jewelry stores
 - 5945 - Hobby, toy and game shops
 - 5947 - Gift, novelty and souvenir shops
 - 5949 - Sewing, needlework and piece goods stores
 - 5961 - Mail order houses
 - 5982 - Fuel and ice dealers, except fuel oil dealers and bottled gas dealers
 - 5983 - Fuel oil dealers
 - 5984 - Liquified petroleum gas (bottled gas) dealers
 - 5992 - Florists
 - 5993 - Cigar stores and stands
 - 5999 - Miscellaneous retail stores, n.e.c.

3. Services

- A. Hotel, Rooming Houses, Camps and Other Lodging Places
 - 7011 - Hotels, motels and tourist courts
- B. Personal Services
 - 7211 - Power laundries, family and commercial
 - 7216 - Dry cleaning plants except rug cleaning
 - 7217 - Carpet and upholstery cleaning
 - 7261 - Funeral service and crematories
 - 7299 - Miscellaneous personal services
- C. Business Services
 - 7311 - Advertising agencies
 - 7312 - Outdoor advertising services
 - 7374 - Data processing services
 - 7394 - Equipment rental and leasing services
- D. Automotive Repair, Services and Garages
 - 7513 - Truck rental and leasing, without drivers
 - 7538 - General automotive repair shops
 - 7542 - Car washes
- E. Miscellaneous Repair Services
 - 7622 - Radio and television repair shops
 - 7623 - Refrigeration and air conditioning service and repair shops
 - 7629 - Electrical and electronic repair shops, n.e.c.

TABLE A.3: Cont

- E. Cont.
 - 7641 - Reupholstery and furniture repair
 - 7692 - Welding repair
 - 7694 - Armature rewinding shops
 - 7699 - Repair shops and related services, n.e.c.
- F. Amusement and Recreation Services, except Motion Pictures
 - 7933 - Bowling Alleys
- G. Miscellaneous Services
 - 8911 - Engineering, architectural and surveying services

TABLE A.4: Services Offered in the Central Villages of Southcentral Michigan, 1950

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Grocery Stores	116	.86	1	9	9.00	4	4.00	24	3.00	19	3.40	25	4.20	35	1.75
Service Stations	107	.93	2	8	8.00	1	1.00	28	4.00	21	3.50	23	2.10	26	1.30
Filling Stations	70	1.43	3	0	0.00	5	5.00	15	2.10	11	1.80	11	1.00	28	1.40
Hardware Stores	53	1.89	4	2	2.00	2	2.00	11	1.60	9	1.50	9	.80	20	1.00
Restaurant	49	2.04	5	5	5.00	2	2.00	12	1.70	10	1.70	7	.64	13	.65
Drugs & Misc.	42	2.38	6	3	3.00	2	2.00	11	1.57	8	1.34	10	.91	8	.40
General Store	39	2.56	7	1	1.00	0	0.00	5	.71	7	1.17	13	1.18	13	.65
Food Stores & Misc.	38	2.63	8	2	2.00	1	1.00	10	1.43	7	1.17	9	.82	9	.45
Automobiles & Tractors	37	2.70	9	0	0.00	2	2.00	17	2.42	9	1.50	6	.55	3	.15
Taverns	33	3.03	10	2	2.00	3	3.00	9	1.29	3	.50	4	.36	12	.60
Implements (Agricul.)	30	3.33	11	3	3.00	0	0.00	8	1.14	5	.83	7	.64	7	.35
Electric Supplies (Sales & Service)	29	3.45	12	1	1.00	3	3.00	4	.57	7	1.17	8	.73	6	.30
Garages	28	3.57	13	0	0.00	2	2.00	3	.43	2	.34	6	.55	15	.75
Variety & Gift Shops	27	3.70	14	1	1.00	1	1.00	11	1.57	7	1.17	2	.18	5	.25
Auto Body Shops	26	3.85	15	3	3.00	0	0.00	8	1.14	5	.83	2	.18	8	.40
Funeral Homes & Morticians	26	3.85	15	1	1.00	0	0.00	6	.86	4	.67	7	.64	8	.40
General Hardware	26	3.85	15	2	2.00	1	1.00	4	.57	5	.83	7	.64	7	.35
Plumbing & Heating	25	4.00	16	0	0.00	0	0.00	10	1.43	7	1.17	4	.36	4	.20
Machine Shops & Supplies	25	4.00	16	5	5.00	1	1.00	2	.29	6	1.00	6	.55	5	.25
Confectionery & Misc.	21	4.76	17	1	1.00	3	3.00	7	1.00	4	.67	1	.09	5	.25
Elevator (Implements Fuel, Feed & Lumber)	20	5.00	18	0	0.00	1	1.00	6	.86	2	.34	3	.27	8	.40
Furniture Stores	18	5.55	19	0	0.00	1	1.00	6	.86	2	.34	4	.36	5	.25
Jewelry Stores	17	5.88	20	2	2.00	2	2.00	8	1.14	1	.17	3	.27	1	.05
Publishing & Printing	17	5.88	20	1	1.00	1	1.00	6	.86	4	.67	2	.18	3	.15
Auto Supply (Sales & Service)	17	5.88	20	2	2.00	3	3.00	4	.57	2	.34	4	.36	2	.10
Shoe & Harness Repair	15	6.66	21	1	1.00	0	0.00	4	.57	4	.67	3	.27	3	.15
Elevator (grain, beans, soybeans)	15	6.66	21	0	0.00	0	0.00	3	.43	1	.17	5	.45	6	.30
Oil & Gas (Dist.Co)	15	6.66	21	1	1.00	1	1.00	3	.43	3	.50	4	.36	3	.15
Radio (Sales & Serv.)	14	7.14	22	1	1.00	0	0.00	4	.57	4	.67	3	.27	2	.10
Men's Wear & Misc.	14	7.14	22	2	2.00	2	2.00	5	.71	2	.34	0	0.00	3	.15
Lunchrooms	13	7.69	23	1	1.00	0	0.00	3	.43	4	.67	4	.36	1	.05
Meat	12	8.33	24	1	1.00	0	0.00	6	.86	1	.17	2	.18	2	.10
Welding & Repair	12	8.33	24	0	0.00	0	0.00	5	.71	1	.17	3	.27	3	.15

TABLE A.4: Cont

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages N	Average	Second Order Villages N	Average	Third Order Villages N	Average	Fourth Order Villages N	Average	Fifth Order Villages N	Average	Sixth Order Villages N	Average
Dry Cleaners & Laundry	11	9.09	25	1	1.00	2	2.00	4	.57	2	.34	1	.09	1	.05
Women's & Children's Dry Goods	11	9.09	25	2	2.00	1	1.00	2	.29	1	.17	3	.27	2	.10
Dairy Products	10	10.00	26	1	1.00	2	2.00	2	.29	3	.50	1	.09	1	.05
Farm Machinery	10	10.00	26	2	2.00	1	1.00	2	.29	2	.34	1	.09	2	.10
Feed Stores	10	10.00	26	1	1.00	0	0.00	2	.29	3	.50	1	.09	3	.15
Food Lockers	10	10.00	26	0	0.00	1	1.00	2	.29	3	.50	2	.18	2	.10
Florist (Greenhouse)	10	10.00	26	2	2.00	1	1.00	2	.29	4	.67	0	0.00	1	.05
Paint & Wallpaper	9	11.11	27	1	1.00	0	0.00	2	.29	1	.17	2	.18	3	.15
Plumbing	8	12.50	28	2	2.00	1	1.00	0	0.00	2	.34	3	.27	0	0.00
Telephone Co. & Service	8	12.50	28	0	0.00	0	0.00	2	.29	2	.34	2	.18	2	.10
Fuel, Coal, Feed, etc.	7	14.28	29	0	0.00	1	1.00	5	.71	0	0.00	0	0.00	1	.05
Produce Co.	7	14.28	29	0	0.00	2	2.00	1	.14	2	.34	2	.18	0	0.00
Sporting Goods	7	14.28	29	0	0.00	1	1.00	3	.43	2	.34	0	0.00	1	.05
Bakery & Misc.	6	16.67	30	0	0.00	0	0.00	5	.71	1	.17	0	0.00	0	0.00
General Store & Misc.	6	16.67	30	1	1.00	0	0.00	3	.43	2	.34	0	0.00	0	0.00
Women's Wear Shop	6	16.67	30	0	0.00	2	2.00	2	.29	1	.17	0	0.00	1	.05
Blacksmith	5	20.00	31	0	0.00	0	0.00	3	.43	0	0.00	1	.09	1	.05
Flour & Feed	5	20.00	31	1	1.00	0	0.00	2	.29	1	.17	1	.09	0	0.00
Flour Milling	5	20.00	31	1	1.00	0	0.00	1	.14	2	.34	1	.09	0	0.00
Trucking	5	20.00	31	0	0.00	0	0.00	3	.43	0	0.00	1	.09	1	.05
Auto-Farm Implements	4	25.00	32	0	0.00	1	1.00	0	0.00	0	0.00	2	.18	1	.05
Books & Newspapers	4	25.00	32	0	0.00	1	1.00	0	0.00	0	0.00	3	.27	0	0.00
Dairy Products & Poultry	4	25.00	32	0	0.00	0	0.00	0	0.00	1	.17	3	.27	0	0.00
Fruits	4	25.00	32	0	0.00	1	1.00	0	0.00	1	.17	2	.18	0	0.00
Hotel & Misc.	4	25.00	32	1	1.00	0	0.00	1	.14	0	0.00	2	.18	0	0.00
Printing	4	25.00	32	0	0.00	0	0.00	0	0.00	1	.17	1	.09	2	.10
Vegetables	4	25.00	32	0	0.00	0	0.00	0	0.00	2	.34	1	.09	1	.05
Well Drilling	4	25.00	32	0	0.00	0	0.00	0	0.00	1	.17	3	.27	0	0.00
Beverage Dealers	3	33.33	33	0	0.00	0	0.00	2	.29	0	0.00	1	.09	0	0.00
Billiards	3	33.33	33	1	1.00	0	0.00	0	0.00	1	.17	0	.09	0	0.00
Bowling	3	33.33	33	0	0.00	0	0.00	3	.43	0	0.00	0	0.00	0	0.00
Cider & Vinegar	3	33.33	33	0	0.00	0	0.00	2	.29	1	.17	0	0.00	0	0.00
Department Store	3	33.33	33	1	1.00	1	1.00	0	0.00	1	.17	0	0.00	0	0.00
House Furnishings	3	33.33	33	0	0.00	0	0.00	1	.14	2	.34	0	0.00	0	0.00
Household Goods	3	33.33	33	0	0.00	0	0.00	1	.14	1	.17	0	0.00	1	.05
Men's, Women's & Children's Wear	3	33.33	33	1	1.00	0	0.00	1	.14	1	.17	0	0.00	0	0.00

TABLE A.4: Cont

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Nurseries	3	33.33	33	0	0.00	0	0.00	2	.29	1	.17	0	0.00	0	0.00
Patent Medicines	3	33.33	33	0	0.00	0	0.00	0	0.00	0	0.00	1	.09	2	.10
Publishing	3	33.33	33	0	0.00	1	1.00	1	.14	1	.17	0	0.00	0	0.00
Shoes	3	33.33	33	1	1.00	1	1.00	1	.14	0	0.00	0	0.00	0	0.00
Antiques	2	50.00	34	0	0.00	0	0.00	0	0.00	1	.17	1	.09	0	0.00
Chemical & Allied Products	2	50.00	34	0	0.00	0	0.00	2	.29	0	0.00	0	0.00	0	0.00
Family Clothing	2	50.00	34	0	0.00	0	0.00	2	.29	0	0.00	0	0.00	0	0.00
Dress Shops	2	50.00	34	0	0.00	0	0.00	1	.14	1	.17	0	0.00	0	0.00
Hauling	2	50.00	34	0	0.00	0	0.00	1	.14	0	0.00	1	.09	0	0.00
Photo	2	50.00	34	1	1.00	0	0.00	1	.14	0	0.00	0	0.00	0	0.00
Tractors	2	50.00	34	0	0.00	1	1.00	0	0.00	1	.17	0	0.00	0	0.00
Trailers	2	50.00	34	0	0.00	0	0.00	1	.09	0	0.00	1	.09	0	0.00
Violins	2	50.00	34	0	0.00	0	0.00	2	.29	0	0.00	0	0.00	0	0.00
Auto Wash	1	100.00	35	1	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Bicycles	1	100.00	35	0	0.00	0	0.00	0	0.00	0	0.00	1	.09	0	0.00
Boats	1	100.00	35	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Farm Grocery	1	100.00	35	0	0.00	0	0.00	1	.14	0	0.00	0	0.00	0	0.00
Heating	1	100.00	35	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Household Specialties	1	100.00	35	1	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Millinery	1	100.00	35	0	0.00	0	0.00	1	.14	0	0.00	0	0.00	0	0.00
Pharmacy	1	100.00	35	0	0.00	0	0.00	1	.14	0	0.00	0	0.00	0	0.00
Pumps	1	100.00	35	1	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Recreation	1	100.00	35	1	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Hospital Equipment	1	100.00	35	0	0.00	0	0.00	1	.14	0	0.00	0	0.00	0	0.00
Upholstering	1	100.00	35	0	0.00	0	0.00	0	0.00	0	0.00	1	.09	0	0.00
Yarn	1	100.00	35	0	0.00	1	1.00	0	0.00	0	0.00	0	0.00	0	0.00
Total Functional Units	1301														

SOURCE: Table A.1

TABLE A.5: Services Offered in the Central Villages of Southcentral Michigan, 1970

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages N	First Order Average	Second Order Villages N	Second Order Average	Third Order Villages N	Third Order Average	Fourth Order Villages N	Fourth Order Average	Fifth Order Villages N	Fifth Order Average	Sixth Order Villages N	Sixth Order Average
Gas Service Stations	102	.98	1	16	5.33	12	3.00	16	3.2	24	3.43	17	1.42	17	1.13
Grocery Stores	93	1.08	2	15	5.00	13	3.25	14	2.8	17	2.43	16	1.33	18	1.20
Hardware Stores	49	2.04	3	5	1.70	9	2.25	6	1.2	9	1.29	13	1.08	7	.47
Drinking Places (Bars and Taverns)	43	2.33	4	7	2.33	6	1.50	6	1.2	6	.86	9	.75	9	.60
Farm Equipment dealers	41	2.44	5	4	1.33	10	2.50	3	.60	10	1.43	3	.25	11	.73
Lumber & Building Materials Dealers	37	2.70	6	3	1.00	6	1.50	3	.60	9	1.29	11	.92	5	.33
Eating Places	34	2.94	7	9	3.00	3	.75	7	1.40	8	1.14	4	.33	3	.20
Drug Stores	31	3.23	8	5	1.70	6	1.50	5	1.00	7	1.00	5	.42	3	.20
Feed Stores	31	3.23	8	3	1.00	7	1.75	4	.80	6	.86	7	.58	4	.27
Motor Vehicle Dealers	28	3.57	9	8	2.70	6	1.50	5	1.00	8	1.14	0	0.00	1	.07
Funeral Services & Crematories	25	4.00	10	5	1.70	1	.25	4	.80	7	1.00	4	.33	4	.80
Misc. General Merchandise Store	24	4.17	11	2	.67	3	.75	6	1.20	6	.86	2	.17	5	.33
Wholesalers	19	5.26	12	3	1.00	5	1.25	3	.60	5	.71	2	.17	1	.07
Repair Shops & Services	17	5.88	13	7	2.33	3	.75	1	.20	1	.14	4	.33	1	.07
Radio & TV Stores	16	6.25	14	3	1.00	2	.50	6	1.20	2	.29	2	.17	1	.07
Furniture Stores	15	6.67	15	2	.67	3	.75	1	.20	6	.86	3	.25	0	0.00
General Automobile Repair Shops	13	7.70	16	1	.33	2	.50	2	.40	3	.43	1	.08	4	.27
Petrol. & Petrol. Products	13	7.70	16	2	.67	5	1.25	2	.40	1	.14	1	.08	2	.13
Variety Stores	12	8.33	17	2	.67	2	.50	1	.20	5	.71	1	.08	1	.07
Women's ready-to-wear Stores	11	9.09	18	2	.67	2	.50	4	.80	2	.29	0	0.00	1	.07
Radio/TV Repair Shops	10	10.00	19	3	1.00	2	.50	3	.60	1	.14	1	.08	0	0.00
Sporting Goods Stores	10	10.00	19	1	.33	2	.50	3	.60	3	.43	1	.08	0	0.00
Florists	9	11.11	20	2	.67	2	.50	1	.20	4	.57	0	0.00	0	0.00
Jewelry Stores	9	11.11	20	3	1.00	2	.50	2	.40	1	.14	0	0.00	1	.07
Tire, Battery & Accessories Dealers	9	11.11	20	3	1.00	3	.75	0	0.00	1	.14	1	.08	1	.07
Bowling Alleys	8	12.50	21	3	1.00	2	.50	1	.20	2	.29	0	0.00	0	0.00
Gift Shops	8	12.50	21	3	1.00	0	0.00	1	.20	2	.29	0	0.00	2	.13

TABLE A.5: Cont

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Lumber & Const.															
Materials	8	12.50	21	1	.33	1	.25	1	.20	2	.29	2	.17	1	.07
Dairy Products	7	14.29	22	1	.33	1	.25	3	.60	2	.29	0	0.00	0	0.00
Grain Elevators	7	14.29	22	1	.33	1	.25	0	0.00	2	.29	1	.08	2	.13
Liquor Stores	7	14.29	22	2	.67	2	.50	0	0.00	1	.14	2	.17	0	0.00
Department Stores	6	16.67	23	3	1.00	1	.25	0	0.00	2	.29	0	0.00	0	0.00
Dry Cleaning	6	16.67	23	2	.67	2	.50	0	0.00	2	.29	0	0.00	0	0.00
Farm/Garden Supply															
Stores	6	16.67	23	0	0.00	3	.75	0	0.00	2	.29	0	0.00	1	.07
Fuel Oil Dealers	6	16.67	23	0	0.00	3	.75	0	0.00	1	.14	1	.08	1	.07
House Trailer															
Dealers	6	16.67	23	1	.33	1	.25	2	.40	1	.14	1	.08	0	0.00
Meat & Fish Market	6	16.67	23	1	.33	2	.50	1	.20	0	0.00	2	.17	0	0.00
Misc. Retail Stores	6	16.67	23	3	1.00	1	.25	0	0.00	0	0.00	1	.08	1	.07
Boat Dealers	5	20.00	24	1	.33	0	0.00	2	.40	1	.14	1	.08	0	0.00
Fuel & Ice Dealers	5	20.00	24	1	.33	2	.50	1	.20	1	.14	0	0.00	0	0.00
Men's & Boys'															
Clothing Store	5	20.00	24	2	.67	2	.50	1	.20	0	0.00	0	0.00	0	0.00
Retail Bakeries	5	20.00	24	1	.33	1	.25	3	.60	0	0.00	0	0.00	0	0.00
Automotive Equipment	4	25.00	25	2	.67	1	.25	0	0.00	0	0.00	1	.08	0	0.00
Family Clothing Stores	4	25.00	25	0	0.00	1	.25	0	0.00	1	.14	1	.08	1	.07
Liquified Petro/Gas															
Dealers	4	25.00	25	0	0.00	1	.25	0	0.00	1	.14	2	.17	0	0.00
Plumbing & Heating	4	25.00	25	2	.67	0	0.00	0	0.00	1	.14	1	.08	0	0.00
Shoe Stores	4	25.00	25	0	0.00	2	.50	2	.40	0	0.00	0	0.00	0	0.00
Antique Sthores	3	33.33	26	2	.67	0	0.00	0	0.00	0	0.00	1	.08	0	0.00
Candy/Confectionary															
Stores	3	33.33	26	0	0.00	1	.25	0	0.00	1	.14	1	.08	0	0.00
Household Appliance															
Stores	3	33.33	26	1	.33	0	0.00	1	.20	1	.14	0	0.00	0	0.00
Meat & Fish Products	3	33.33	26	1	.33	0	0.00	0	0.00	0	0.00	2	.17	0	0.00
Used Car Dealers	3	33.33	26	1	.33	1	.25	0	0.00	1	.14	0	0.00	0	0.00
Paper & Paper															
Products	3	33.33	26	1	.33	2	.50	0	0.00	0	0.00	0	0.00	0	0.00
Poultry & Poultry															
Products	3	33.33	26	0	0.00	2	.50	0	0.00	1	.14	0	0.00	0	0.00
Tires & Tubes	3	33.33	26	0	0.00	2	.50	0	0.00	0	0.00	0	0.00	1	.07
Welding Repair	3	33.33	26	1	.33	0	0.00	1	.20	0	0.00	0	0.00	1	.07

TABLE A.5: Cont

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Armature Re-winding	2	50.00	27	0	0.00	1	.25	0	0.00	0	0.00	1	.08	0	0.00
Business Services	2	50.00	27	0	0.00	0	0.00	0	0.00	1	.14	1	.08	0	0.00
Dairy Product Stores	2	50.00	27	1	.33	0	0.00	0	0.00	1	.14	0	0.00	0	0.00
Electrical Repair Shops	2	50.00	27	0	0.00	0	0.00	1	.20	1	.14	0	0.00	0	0.00
Electrical Supply Stores	2	50.00	27	1	.33	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Frozen Foods	2	50.00	27	0	0.00	0	0.00	0	0.00	1	.14	1	.08	0	0.00
Hotels, Tourist Courts & Motels	2	50.00	27	0	0.00	0	0.00	0	0.00	1	.14	1	.08	0	0.00
Paint, Glass & Wallpaper Stores	2	50.00	27	0	0.00	0	0.00	0	0.00	1	.14	1	.08	0	0.00
Second Hand Stores	2	50.00	27	1	.33	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Top & Body Repair Shops	2	50.00	27	0	0.00	0	0.00	0	0.00	0	0.00	2	.17	0	0.00
Watch, Clock & Jewelry Repair	2	50.00	27	0	0.00	1	.25	1	.20	0	0.00	0	0.00	0	0.00
Advertising Agency	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Aircraft & Automobile Dealers	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Automatic Machinery	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Car Washes	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Beer, Wine, Beverages	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Bicycle Shops	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Confectionery	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Construction & Mining Equipment	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Draperies, Curtain & Upholstery Stores	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Equipment Rental & Leasing	1	100.00	28	0	0.00	0	0.00	0	0.00	1	.14	0	0.00	0	0.00
Farm Machinery & Equipment	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Floor Covering Store	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Fresh Fruits & Vegetables	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Groceries & Related Products	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00

TABLE A.5: Cont:

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Hardware (wholesale)	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Industrial Machinery & Equipment	1	100.00	28	0	0.00	0	0.00	0	0.00	1	.14	0	0.00	0	0.00
Industrial Supplies	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Livestock (wholesale)	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Mail Order Houses	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Misc. Advertising	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Misc. Apparel & Accessory	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Photofinishing Laboratory	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Plumbing & Heating Equip. & Supplies	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Professional Equipment & Supplies	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Reupholstery & Furniture Repair	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Rug Cleaning & Repair	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Scrap & Waste Materials	1	100.00	28	0	0.00	1	.25	0	0.00	0	0.00	0	0.00	0	0.00
Tobacco & Tobacco Products	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Truck Rental & Leasing	1	100.00	28	0	0.00	0	0.00	1	.20	0	0.00	0	0.00	0	0.00
Women's Accessory and Specialty Store	1	100.00	28	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total Functional Units	907														

SOURCE: TABLE A.2 services taken from telephone directories (Attorneys to Veterinarians) that are used in the tables of functional indexes for the villages in 1970 and 1980 are not shown here due to the lack of data for 1950.

TABLE A.6: Services Offered in the Central Villages of Southcentral Michigan, 1980

Types of Services (Functions)	Functional Units (N)	Location Co-efficient $LC=1/N*100$	Rank	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Grocery Stores	65	1.54	1	11	3.67	19	2.71	7	1.75	10	1.67	14	1.75	4	.22
Hardware Stores	48	2.08	2	4	1.33	13	1.86	6	1.50	8	1.33	5	.62	12	.67
Gas Service Stations	38	2.63	3	8	2.67	12	1.71	3	.75	4	.67	6	.75	5	.28
Eating Places	36	2.77	4	9	3.00	9	1.29	4	1.00	5	.83	7	.87	2	.11
Lumber & Building Materials	31	3.22	5	4	1.33	8	1.14	5	1.25	4	.67	3	.37	7	.39
Drinking Places (Bars & Taverns)	30	3.33	6	4	1.33	6	.86	2	.50	5	.83	5	.62	8	.44
Motor Vehicle Dealers (New and Used)	30	3.33	6	8	2.67	8	1.14	7	1.75	1	.17	5	.62	1	.06
Farm & Garden Machinery	25	4.00	7	4	1.33	4	.57	3	.75	5	.83	5	.62	4	.22
Drug Stores	22	4.54	8	8	2.67	7	1.00	2	.50	3	.50	2	.25	0	0.00
Farm Supplies	21	4.76	9	1	.33	4	.57	6	1.50	3	.50	2	.25	5	.28
Grain Elevator	21	4.76	9	1	.33	4	.57	4	1.00	5	.83	4	.50	3	.17
Nondurable goods	16	6.25	10	3	1.00	2	.29	4	1.00	1	.17	1	.12	5	.28
Florists	15	6.66	11	4	1.33	3	.43	2	.50	2	.33	4	.50	0	0.00
Sporting Goods Stores	15	6.66	11	4	1.33	5	.71	2	.50	1	.17	0	0.00	3	.17
Furniture Stores	14	7.14	12	5	1.67	3	.43	2	.50	3	.50	1	.12	0	0.00
Misc. General Merchandise Stores	13	7.69	13	1	.33	4	.57	2	.50	1	.17	2	.25	3	.17
Women's Ready-to-Wear Stores	12	8.33	14	4	1.33	5	.71	2	.50	1	.17	0	0.00	0	0.00
Auto & Home Supply Stores	11	9.09	15	2	.67	3	.43	3	.75	1	.17	2	.25	0	0.00
Gift Shops	11	9.09	15	5	1.67	4	.57	0	0.00	1	.17	0	0.00	1	.06
Liquor Stores	11	9.09	15	4	1.33	2	.29	4	1.00	0	0.00	1	.12	0	0.00
Radio & TV Stores	11	9.09	15	2	.67	4	.57	3	.75	1	.17	0	0.00	1	.06
Variety Stores	11	9.09	15	3	1.00	2	.29	2	.50	3	.50	1	.12	0	0.00
Auto Parts/Supplies	10	10.00	16	3	1.00	1	.14	3	.75	1	.17	1	.12	1	.06
Funeral Services & Crematories	9	11.11	17	2	.67	2	.29	2	.50	0	0.00	1	.12	2	.11
General Auto Repair Shops	9	11.11	17	3	1.00	1	.14	1	.25	1	.17	0	0.00	3	.17
Repair Shops	9	11.11	17	1	.33	1	.14	2	.50	1	.17	2	.25	2	.11
Durable Goods	8	12.50	18	5	1.67	2	.29	0	0.00	0	0.00	1	.12	0	0.00
Petroleum	8	12.50	18	3	1.00	3	.43	1	.25	0	0.00	0	0.00	1	.06
Boat Dealers	7	14.28	19	2	.67	2	.29	1	.25	1	.17	1	.12	0	0.00
Fuel Oil Dealers	7	14.28	19	0	0.00	2	.29	2	.50	1	.17	2	.25	0	0.00
Jewelry Stores	7	14.28	19	4	1.33	2	.29	1	.25	0	0.00	0	0.00	0	0.00
Radio & TV Repair Shops	7	14.28	19	0	0.00	4	.57	2	.50	0	0.00	0	0.00	1	.06

TABLE A.6: Cont

Types of Services (Functions)	Functional Units (N)	Location Co-efficient		First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
		LC=1/N*100	Rank	N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Retail nurseries	7	14.28	19	2	.67	1	.14	0	0.00	2	.33	1	.12	1	.06
Construction															
Materials	6	16.66	20	1	.33	3	.43	2	.50	0	0.00	0	0.00	0	0.00
Floor Covering Stores	6	16.66	20	2	.67	3	.43	0	0.00	0	0.00	1	.12	0	0.00
Men's & Boys' Clothing	6	16.66	20	2	.67	3	.43	1	.25	0	0.00	0	0.00	0	0.00
Sewing Stores	6	16.66	20	1	.33	2	.29	0	0.00	0	0.00	3	.37	0	0.00
Cigar Stores	5	20.00	21	4	1.33	0	0.00	0	0.00	0	0.00	1	.12	0	0.00
Family Clothing Stores	5	20.00	21	0	0.00	1	.14	2	.50	2	.33	0	0.00	0	0.00
Industrial Supplies	5	20.00	21	3	1.00	1	.14	1	.25	0	0.00	0	0.00	0	0.00
Misc. Home Furnishings	5	20.00	21	1	.33	0	0.00	0	0.00	1	.17	3	.37	0	0.00
Mobile Home Dealers	5	20.00	21	0	0.00	1	.14	0	0.00	2	.33	2	.25	0	0.00
Petrol (Bulk) Stations	5	20.00	21	0	0.00	2	.29	0	0.00	1	.17	0	0.00	2	.11
Bowling Alleys	4	25.00	22	2	.67	0	0.00	1	.25	1	.17	0	0.00	0	0.00
Data Processing Services	4	25.00	22	3	1.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Liq. Petrol. Gas Dealers	4	25.00	22	0	0.00	2	.29	0	0.00	1	.17	0	0.00	1	.06
Lumber, Plywood and Millwork	4	25.00	22	0	0.00	1	.14	0	0.00	1	.17	1	.12	1	.06
Misc. Retail Stores	4	25.00	22	0	0.00	2	.29	1	.25	1	.17	0	0.00	0	0.00
Paint, Glass & Wallpaper Stores	4	25.00	22	1	.33	1	.14	0	0.00	0	0.00	1	.12	1	.06
Reupholstery & Furniture Repair	4	25.00	22	0	0.00	2	.29	1	.25	1	.17	0	0.00	0	0.00
Used Merchandise Stores	4	25.00	22	1	.33	1	.14	0	0.00	0	0.00	2	.25	0	0.00
Department Stores	3	33.33	23	2	.67	0	0.00	1	.25	0	0.00	0	0.00	0	0.00
Electrical and Electronic Repair Shops	3	33.33	23	1	.33	1	.14	1	.25	0	0.00	0	0.00	0	0.00
Engineering Services	3	33.33	23	0	0.00	0	0.00	2	.50	1	.17	0	0.00	0	0.00
Meat & Fish Markets	3	33.33	23	0	0.00	1	.14	0	0.00	1	.17	1	.12	0	0.00
Motorcycle Dealers	3	33.33	23	1	.33	0	0.00	1	.25	0	0.00	0	0.00	1	.06
Used Car Dealers	3	33.33	23	0	0.00	2	.29	0	0.00	1	.17	0	0.00	0	0.00
Refrig. & Air Conditioning	3	33.33	23	0	0.00	1	.14	0	0.00	1	.17	0	0.00	1	.06
Sporting & Recreational Goods/Supplies	3	33.33	23	0	0.00	2	.29	0	0.00	1	.17	0	0.00	0	0.00
Advertising Agencies	2	50.00	24	0	0.00	1	.14	1	.25	0	0.00	0	0.00	0	0.00
Armature Rewinding Shops	2	50.00	24	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	1	.06
Automotive Dealers	2	50.00	24	0	0.00	0	0.00	0	0.00	1	.17	1	.12	0	0.00
Candy and Confectionery	2	50.00	24	0	0.00	2	.29	0	0.00	0	0.00	0	0.00	0	0.00
Confectionery	2	50.00	24	0	0.00	2	.29	0	0.00	0	0.00	0	0.00	0	0.00
Equipment Rental/Leasing	2	50.00	24	0	0.00	1	.14	0	0.00	1	.17	0	0.00	0	0.00
Groceries (Gen. Line)	2	50.00	24	0	0.00	2	.29	0	0.00	0	0.00	0	0.00	0	0.00

TABLE A .6 Cont:

Types of Services (Functions)	Functional Units (N)	Location Co-efficient LC=1/N*100	Rank	First Order Village		Second Order Village		Third Order Village		Fourth Order Village		Fifth Order Village		Sixth Order Village	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Hobby, Toy & Game Shops	2	50.00	24	0	0.00	2	.29	0	0.00	0	0.00	0	0.00	0	0.00
Hotels, Motels & Tourist Courts	2	50.00	24	0	0.00	0	0.00	1	.25	1	.17	0	0.00	0	0.00
Household Appliance Stores	2	50.00	24	1	.33	0	0.00	0	0.00	0	0.00	1	.12	0	0.00
Misc. Apparel & Accessory Stores	2	50.00	24	0	0.00	0	0.00	1	.25	1	.17	0	0.00	0	0.00
Music Stores	2	50.00	24	0	0.00	0	0.00	2	.50	0	0.00	0	0.00	0	0.00
Poultry & Poultry Products	2	50.00	24	0	0.00	2	.29	0	0.00	0	0.00	0	0.00	0	0.00
Professional Equipment & Supplies	2	50.00	24	0	0.00	0	0.00	0	0.00	0	0.00	1	.12	1	.06
Recreational & Utility Trailers	2	50.00	24	1	.33	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Truck Rental & Leasing	2	50.00	24	0	0.00	1	.14	0	0.00	1	.17	0	0.00	0	0.00
Beer & Ale Stores	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Carpet Cleaning	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Car Wash	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Children's, Infant's Wear Stores	1	100.00	25	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Dairy Products Store	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Draperies, Curtain & Upholstery Store	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Dry Cleaning	1	100.00	25	0	0.00	0	0.00	1	.25	0	0.00	0	0.00	0	0.00
Farm Product (Raw Materials)	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Freezer & Locker Meat Provisions	1	100.00	25	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Fruit & Vegetable Market	1	100.00	25	0	0.00	0	0.00	0	0.00	1	.17	0	0.00	0	0.00
Fuel & Ice Dealers	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Groceries & Related Products	1	100.00	25	0	0.00	0	0.00	0	0.00	0	0.00	1	.12	0	0.00
Industrial&Personal Paper Products	1	100.00	25	0	0.00	0	0.00	1	.25	0	0.00	0	0.00	0	0.00
Industrial Machinery and Equipment	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Livestock	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Mail Order Houses	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Metal Service Centers	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Misc. Food Stores	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00

TABLE A.6: Cont

Types of Services (Functions)	Functional Units (N)	Location Co- efficient LC=1/N*100	Rank	First Order Village		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
				N	Average	N	Average	N	Average	N	Average	N	Average	N	Average
Misc. Personal Services	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Outdoor Advertising	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Plumb. & Heating	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Family & Commercial Laundries	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Retail Bakeries	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Service Establishment Equipment & Supplies	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Shoe Stores	1	100.00	25	0	0.00	0	0.00	0	0.00	0	0.00	1	.12	0	0.00
Stationery Supplies	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Tires & Tubes	1	100.00	25	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Transportation Equip- ment	1	100.00	25	0	0.00	0	0.00	0	0.00	0	0.00	1	.12	0	0.00
Welding Repair	1	100.00	25	0	0.00	1	.14	0	0.00	0	0.00	0	0.00	0	0.00
Total Functional Units	763														

SOURCE: TABLE A.3: Services from telephone directories used in tables of functional indexes for villages are not shown here due to lack of data for 1950.

TABLE A.7: Other Services Offered in Central Villages, Southcentral Michigan, 1970

Types of Services (Functions)	Functional Units (N)	Location- Coefficient (L.C.)	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
			N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.
School	97	1.03	10	3.33	10	2.50	17	3.40	21	3.00	24	2.00	15	1.00
Church	89	1.12	11	3.67	13	3.25	20	4.00	21	3.00	12	1.00	12	.80
Bank	36	2.78	3	1.00	4	1.00	6	1.20	7	1.00	10	.83	6	.40
Doctors' Office	28	3.57	9	3.00	3	.75	7	1.40	5	.71	4	.33	0	0.00
Barbarshop	22	4.54	2	.67	4	1.00	8	1.60	4	.57	3	.25	1	.07
Dentist	21	4.76	5	1.67	5	1.25	6	1.20	4	.57	1	.08	0	0.00
Attorney	15	6.67	7	2.33	0	0.00	3	.60	3	.43	1	.08	1	.07
Veterinarian	11	9.09	1	.33	4	1.00	1	.20	2	.29	1	.08	2	.13
Optometrist	2	50.00	1	.33	0	0.00	0	0.00	0	0.00	1	.08	0	0.00
Clinic	1	100.00	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Hospital	1	100.00	0	.33	0	0.00	1	.20	0	0.00	0	0.00	0	0.00

SOURCE: Data is derived from Table A.2

TABLE A.8: Other Services Offered in Central Villages, Southcentral Michigan, 1980

Types of Services (Functions)	Functional Units (N)	Location- Coefficient (L.C.)	First Order Villages		Second Order Villages		Third Order Villages		Fourth Order Villages		Fifth Order Villages		Sixth Order Villages	
			N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.
Church	195	.51	32	10.67	47	6.71	27	6.75	27	4.50	30	3.75	32	1.78
School	69	1.45	12	4.00	15	2.14	9	2.25	9	1.50	13	1.63	11	.61
Doctors' Office	64	1.56	29	9.67	13	1.86	9	2.25	7	1.17	3	.38	3	.17
Bank	47	2.13	8	2.67	10	1.43	5	1.25	7	1.17	7	.88	10	.56
Dentist	36	2.77	10	3.33	11	1.57	5	1.25	4	.67	3	.38	3	.17
Attorney	32	3.12	11	3.67	9	1.28	3	.75	1	.17	6	.75	2	.11
Veterinarian	32	3.12	5	1.67	13	1.86	4	1.00	3	.50	3	.38	4	.22
Barbershop	27	3.70	5	1.67	8	1.14	9	2.25	3	.50	1	.13	1	.06
Optometrist	9	11.11	2	.67	2	.29	3	.75	0	0.00	1	.13	1	.06
Clinic	8	12.50	4	1.33	2	.29	1	.25	0	0.00	1	.13	0	0.00
Hospital	1	100.00	1	.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

SOURCE: Data is derived from Table A.3

A P P E N D I X : B

Village
Date
Name

Public Questionnaire

Cultural and Social Aspects:

1. Do you have any housing and mobile home development in your village? Yes ☐ No ☐
 If yes, when _____ ? and why?
 1a. Is that mostly related to the migration of retired farmers to your village? Yes ☐ No ☐
 1b. Is that because of some job opportunities in this community? Yes ☐ No ☐
 1c. Is that because of increased mobility and commuting opportunities for people who have their jobs outside the village? Yes ☐ No ☐
2. Did you have any farm depopulation in the adjoining farms? Yes ☐ No ☐ If yes, when? _____ and why?
3. Do you still have the district school in this village? Yes ☐ No ☐
 3a. Is the district school consolidated with other district schools? Yes ☐ No ☐
 If Yes, when _____ ? with which ones _____ ? and why?
 3b. Does the consolidated school function better than the district schools? Yes ☐ No ☐
4. Did you have any church consolidation? Yes ☐ No ☐ If yes, when? _____ with which ones _____ ? and why?

Functional and Economic Aspects:

1. Which services of this village are vital to farmers: Food ☐ ? Household's Needs ☐ ?
 Agricultural ☐ ? Social ☐ ? Educational ☐ ? Health Centers ☐ ? Commercial ☐ ? Elevator ☐ ? Bank ☐ ?
 Employment ☐ ? Others ☐ ?
2. Do you believe that the income of farmers has been increased significantly in the seventies? Yes ☐ No ☐
 2a. Did the increase of farmer's income encourage them to visit this village more often than the past? Yes ☐ No ☐
 2b. Did the increase of income encourage the farmers to buy better and specialized goods? Yes ☐ No ☐
 If yes, from here ☐ ? or other centers ☐ ? Please give the names?
3. Do you think that the recent decrease of farmer's income (1980's) has changed their shopping behavior toward this community? Yes ☐ No ☐ If yes, explain:

 3a. Do the farmers visit this village less often in present time rather than the past? Yes ☐ No ☐
 3b. Will the recent reduction of farmer's income influence significantly on their future purchasing power? Yes ☐ No ☐
 Do not know ☐
 3c. Will the decrease of farmer's income change their market centers in the near future? Yes ☐ No ☐ Do not know ☐
 If yes, please explain:

 3d. Do you think that the changes of farmer's income has influenced on the economic conditions of this village? Yes ☐
 No ☐ Do not Know ☐ If yes, please explain:

4. Please complete the following table that includes the functional changes of your community:

Functions	Present Time	Up to 10 Years Ago	10–30 Years Ago
Agriculture	☐	☐	☐
Trade Center	☐	☐	☐
Mineral	☐	☐	☐
Industrial	☐	☐	☐
Dormitory	☐	☐	☐
Recreational	☐	☐	☐

Transportational Developments:

1. When did you have a significant highway development in your community?
How was its impact on retail sales of this village?
Is that favored ☐ or reduced ☐ some certain businesses? Please explain:

2. Do you have any highway that goes through the village or bypass it? Yes ☐ No ☐
 2a. Is that favored or reduced the economic potentiality of this village? Favored ☐ Reduced ☐
 2b. Was it encouraging or discouraging for farmer's visiting of this village? Encouraging ☐ Discouraging ☐

3. Do the farmers shop mostly in this village or they bypass it to reach other centers? Shopping Here ☐ Bypassing Here ☐
If they bypass, what are the advantages of other centers?

4. Do you have any particular goods and services in this village that attract farmers for visiting in here? Yes ☐ No ☐
If yes, give the names of these goods and services:

5. Has the railroad lost its former significance? Yes ☐ No ☐ If yes, when _____ ? and why?
 5a. Had it impact mostly on the transporting of passengers? ☐ Goods ☐ ? or Both of Them ☐ ?
 5b. Are the elevators still important for buying the grains and transporting them by the railroad? Yes ☐ No ☐
 If not, since when _____ ? and why?

Perspectives of the Future:

1. What do you predict for the future of farming in the surrounding areas of your community?

2. What do you predict for the future development of your community? and what are your suggestions?

County Township
 Distance to the Central Village
 Distance to Lansing

Farm Family Questionnaire

1. How long have you been here ? Where did you live before?

Since when have you been a farm operator?

1a. Have you abandoned your farmstead for a while? Yes ☐ No ☐ If yes, when ? and why?

1b. Do you know any abandoned farmsteads in your neighborhood? Yes ☐ No ☐ If yes, since when

and why?

1c. Do you know any farms in your neighborhood that are merely residential? Yes ☐ No ☐ If yes, what percentage of your neighboring farms is residential?

2. Who is (are) the main farm operator(s)? Male head of household ☐ Female head of household ☐ Both ☐ Others ☐
 (Specify)

3. Are you a full-time farmer ☐ part-time farmer ☐ retired farmer ☐ other (specify)?

4. Who is (are) the owner (owners) of your farm?

5. How large is your farm? acres.

5a. Have you increased your farmlands by purchasing or renting some lands? Yes ☐ No ☐ If yes, when? and why?

5b. Did the increase of your farm size improve the farm outputs? Yes ☐ No ☐

6. What type of farming do you carry on? Please name it:

6a. Did you have some changes in your farming type? Yes ☐ No ☐ If yes, what was that ? when? and why?

6b. Did you switch from the general farming to specialized farming? Yes ☐ No ☐ If yes, when ? and why?

Did it improve the farm outputs? Yes ☐ No ☐

7. How long has your farm been automated?

7a. Do you use the modern tractors? Yes ☐ No ☐ If yes, since when are you using the 2-3 wheel drive tractor or 4 wheel drive tractor?

8. How important have the following been in your farm development?

	Little Importance	Important	Very Important
Farm's Automation			
New Farm Equipment	☐	☐	☐
4 Wheel Drive Tractor	☐	☐	☐
2-3 Wheel Drive Tractor	☐	☐	☐
Corn Combine	☐	☐	☐
New Designed Trucks	☐	☐	☐
New Seeds	☐	☐	☐
New Fertilizers	☐	☐	☐
New Herbicides	☐	☐	☐
New Pesticides	☐	☐	☐
Others (Specify)	☐	☐	☐

9. To what extent these following sources have been important in changing your farm management?

	Very Little	Some Extent	Great Extent
Media (Magazines, TV, Radio, etc.)	☐	☐	☐
Neighbors, Friends, Relatives	☐	☐	☐
Dealers, Salesmen, Buyers	☐	☐	☐
Farm Organizations	☐	☐	☐
Cooperative Extension Service	☐	☐	☐

10. Which of the following gross agriculture sales categories best describes your farm?

- Over \$50,000 ☐
 \$20,000 to \$49,999 ☐
 \$10,000 to \$19,999 ☐
 \$5,000 to \$9,999 ☐
 \$2,500 to \$4,999 ☐
 \$1,000 to \$2,499 ☐
 Under \$1,000 ☐

10a. How much is the percentage of your income from farm and off-farm ?

10b. Did you have any changes of farm income in the past three years? Increase ☐ No Change ☐ Decrease ☐
 Significant Decrease ☐

11. Do you believe that your accessibility to market centers has been increased? Yes ☐ No ☐ If yes, since when? and why?

11a. Which of the following have been important in increasing your accessibility to market centers?

- Having more than one private car ☐
 Modern vehicles that are faster ☐
 Highway development ☐
 Secondary road development ☐
 Increase of speed limitation ☐

12. Do you bypass any small towns to reach the larger ones for your shopping? Yes ☐ No ☐

If yes, since when ? and why?

13. Have you ever changed your major shopping centers? Yes ☐ No ☐ If yes, when ? from where to where and why?

14. Do you think that you used to buy better quality and more specialized items of the following in the past?

☐ Foods, ☐ Clothing, ☐ Furniture, ☐ Farm Machinery & Supplies, ☐ Others,

15. How many times in a week do you visit the market centers now? and before?

15a. Where do you visit for these following goods and services?

Grocery Store , Department Store , Family Clothing , Shoe Store , Floor Covering Store
 Paint & Wallpaper Store , Clinic , Optometrist , Jewelry , Automotive Dealer

16. Please identify your reasons for shopping or visiting choice of those goods and services in that particular market center:

Goods and Services	Distance	Price of Goods	Specialized Goods & Services	Convenience of Shopping	Attractiveness of Market	Save Money	Save Time
Grocery Store	☐	☐	☐	☐	☐	☐	☐
Department Store	☐	☐	☐	☐	☐	☐	☐
Family Clothing	☐	☐	☐	☐	☐	☐	☐
Shoe Store	☐	☐	☐	☐	☐	☐	☐
Floor Covering Store	☐	☐	☐	☐	☐	☐	☐
Paint & Wallpaper Store	☐	☐	☐	☐	☐	☐	☐
Clinic	☐	☐	☐	☐	☐	☐	☐
Optometrist	☐	☐	☐	☐	☐	☐	☐
Jewelry	☐	☐	☐	☐	☐	☐	☐
Automotive Dealer	☐	☐	☐	☐	☐	☐	☐

17. What is your age and your spouse's age? Male ☐ Female ☐

☐ 18-25, ☐ 26-35, ☐ 36-55, ☐ 56-65, ☐ 65 and Over

18. Please identify the educational level of you and your spouse: Male ☐ Female ☐

- ☐ Less than High School
- ☐ High School Graduate or Equivalent
- ☐ Beyond High School
- ☐ Some College or Training
- ☐ College Graduate
- ☐ Graduate Work

19. What changes do you expect in your farm operation in the near future?

- ☐ None ☐ Selling your farm ☐ Finding an off-farm job ☐ Extending your farm

20. How sure are you that you can keep running your farm in the near future?

- ☐ A little sure, ☐ Moderately sure, ☐ Sure, ☐ Completely sure

21. Your comments for the future development of your community:

County	Township
Distance to Central Village	
Distance to Lansing	

Non-Farm Family Questionnaire

1. How long have you been here _____? Where did you live before?
Why did you choose this place for your living?
2. How much is the area of your property? _____ square feet.
2a. Who owns your house?
2b. Was it used as a farm before? Yes ☐ No ☐ If yes, are you an ex-farmer? Yes ☐ No ☐
If yes, why did you change your job?
3. What is the percentage of non-farm families in your neighborhood?
4. Which one of the following is closer to your income level?
☐ Over \$20,000 ☐ \$5,000 to \$9,999 ☐ \$1,000 to \$2,499
☐ \$10,000 to \$19,999 ☐ \$2,500 to \$4,999 ☐ \$ Under \$1,000
4a. Is your income completely ☐ or partly ☐ from off-farm job.
4b. What is your off-farm Job? _____ and in which town do you work?
5. Which one of the following have been important in increasing your accessibility to market centers?
☐ Having more than one private car? ☐ Secondary Road Development
☐ Modern Vehicles that are Faster ☐ Increase of Speed Limitation
☐ Highway Development
6. Do you bypass any small towns to reach the larger ones for your shopping? Yes ☐ No ☐
If yes, since when _____ and why?
7. Have you ever changed your major shopping centers? Yes ☐ No ☐ If yes, when _____ ? from where to where?
and why?
8. Do you think that you used to buy better quality and more specialized items of the following than the past?
☐ Foods ☐ Clothing ☐ Furniture ☐ Others
9. How many times in a week do you visit the market centers now _____ and before _____ ?
9a. Where do you visit for these following goods and services?
Grocery Store _____, Department Store _____, Family Clothing _____, Shoe Store _____, Floor Covering Store _____
Paint and Wallpaper Store _____, Clinic _____, Optometrist _____, Jewelry _____, Automotive Dealer _____

10. Please identify your reasons for shopping or visiting choice of those goods and services in that particular market centers:

[illegible]

11. What is your age and your spouse's age? Male ☐ Female ☐

☐ 18–25, ☐ 26–35, ☐ 36–55, ☐ 56–65, ☐ 66 and Over

12. Please identify the educational level of you and your spouse: Male ☐ Female ☐

☐ Less than High School, ☐ High School Graduate or Equivalent

☐ Beyond High School ☐ Some College or Training

☐ College Graduate ☐ Graduate Work

13. Your comments of the future development of your community:

A P P E N D I X : C

TABLE C.1 : Factors Related to Farmer Families' Selection of Grocery Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-coefficient **	Coef-
<u>Objective Factors</u>					
Distance	13.09437	1	.001 > p > 0	.41496	
Price of Goods	2.99282	2	.5 > p > 2	.18036	
Specialized Goods/ Services	.35376	1	.7 > p > 5	.09759	
Shopping Convenience	2.70204	1	.2 > p > 1	.20576	
Attractiveness of market	0	1	1 > p > .7	.01308	
<u>Subjective Factors</u>					
Saves Money	3.74862	3	.5 > p > .2	.20296	
Saves Time	3.04084	1	.10 > p > .5	.21873	
<u>Farmers' Characteristics</u>					
Income	7.65134	4	.10 > p > .05	.20504	
Age	17.85507	8	.05 > p > .01	.23191	
Education	3.69478	6	1 > p > .7	.10334	
Length of Residence	16.15951	6	.05 > p > .01	.21737	
Shopping, Trips per week	3.16086	4	.7 > p > .5	.13326	
Farm Size	.26421	4	1 > p > .7	.03810	
Farm Consolidation	4.52995	4	.5 > p > .2	.22070	
Full- or Part-time Farming	.24931	2	1 > p > .7	.05263	
Type of Farming (Cash crop, dairy, etc.)	6.95918	2	.05 > p > .01	.27503	
Change to specialization	.27277	1	.7 > p > .5	.09132	
Time of farm automation	.30517	4	1 > p > .7	.04095	

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.2 : Factors Related to Farmer Families' Selection of Optometrist in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	6.52932	1	.05 >p>.01	.30496
Price of Goods	.09273	1	1 >p>.7	.07788
Specialized Goods/Services	13.08686	1	.01 >p>.001	.41989
Shopping Convenience	2.60842	1	.2 >p>.1	.20965
Attractiveness of market	0	1	1 >p>.7	.07630
<u>Subjective Factors</u>				
Saves Money	0	1	1 >p>.7	.02964
Saves Time	17.41803	1	.001 >p> 0	.47284
<u>Farmers' Characteristics</u>				
Income	1.39920	1	.5 >p>.2	.15754
Age	7.97255	2	.05 >p>.01	.22048
Education	2.68927	2	.5 >p>.2	.12690
Length of Residence	4.90184	3	.2 >p>.1	.17503
Shopping, Trips per week	0	1	1 >p>.7	.02296
Farm Size	0	1	1 >p>.7	.00140
Farm Consolidation	1.18990	1	.5 >p>.2	.14748
Full- or Part-time Farming	.74620	2	.7 >p>.5	.09157
Type of Farming (Cash crop, dairy, etc.)	2.91472	1	.1 >p>.05	.21224
Change to specialization	.05464	1	1 >p>.7	.07325
Time of farm automation	.14335	1	1 >p>.7	.06984

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.3 : Factors Related to Farmer Families' Selection of Clinics in a Particular Central Place
(A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	12.98534	1	.001 > p > .0	.41100
Price of Goods	.40451	1	.7 > p > .5	.13561
Specialized Goods/ Services	14.76590	2	.001 > p > .0	.41197
Shopping Convenience	4.18667	1	.05 > p > .01	.24425
Attractiveness of market	0	1	1 > p > .7	.02863
<u>Subjective Factors</u>				
Saves Money	.48549	1	.5 > p > .2	.11952
Saves Time	12.67836	1	.001 > p > .0	.40838
<u>Farmers' Characteristics</u>				
Income	.48475	4	1 > p > .7	.07422
Age	3.32044	4	.7 > p > .5	.10186
Education	6.88784	2	.05 > p > .01	.20494
Length of Residence	1.45143	2	.5 > p > .2	.09554
Shopping, Trips per week	.21547	2	1 > p > .7	.05065
Farm Size	4.34610	2	.2 > p > .1	.22351
Farm Consolidation	.61333	2	1 > p > .7	.08545
Full- or Part-time Farming	2.57218	2	.5 > p > .2	.17396
Type of Farming (Cash crop, dairy, etc.)	1.24524	2	.7 > p > .5	.11965
Change to specialization	.00814	1	1 > p > .7	.04904
Time of farm automation	2.96770	2	.5 > p > .2	.18469

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.4 : Factors Related to Farmer Families' Selection of Floor Covering Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	1.29118	1	.5 > p>.2	.17324
Price of Goods	2.32127	1	.2 > p>.1	.20842
Specialized Goods/ Services	1.99867	1	.2 > p>.1	.19742
Shopping Convenience	.41989	1	.7 > p>.5	.11114
Attractiveness of market	.56886	1	.5 > p>.2	.14085
<u>Subjective Factors</u>				
Saves Money	5.97978	1	.05 > p>.01	.30732
Saves Time	.73906	1	.5 > p>.2	.13763
<u>Farmers' Characteristics</u>				
Income	.08070	1	1 > p>.7	.08169
Age	.99929	2	.7 > p>.5	.08108
Education	.09454	1	1 > p>.7	.04804
Length of Residence	.29322	1	1 > p>.7	.06371
Shopping, Trips per week	0	1	1 > p>.7	.02776
Farm Size	0	1	1 > p>.7	.01999
Farm Consolidation	.74480	1	.5 > p>.2	.13743
Full- or Part-time Farming	.05948	1	1 > p>.7	.06637
Type of Farming (Cash crop, dairy, etc.)	.94136	1	.5 > p>.2	.14534
Change to specialization	0	1	1 > p>.7	.00483
Time of farm automation	0	1	1 > p>.7	.02734

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.5 : Factors Related to Farmer Families' Selection of Jewelry Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors.</u>				
Distance	1.41866	1	.5>p>.2	.21437
Price of Goods	.86349	1	.5>p>.2	.17171
Specialized Goods/Services	1.442240	1	.5>p>.2	.20599
Shopping Convenience	.24154	1	.7>p>.5	.12193
Attractiveness of market	.38133	1	.7>p>.5	.15090
<u>Subjective Factors</u>				
Saves Money	1.86513	1	.2>p>.1	.22942
Saves Time	1.08823	1	.3>p>.2	.19672
<u>Farmers' Characteristics</u>				
Income	1.17081	1	.5>p>.2	.19723
Age	.04096	1	1 >p>.7	.05346
Education	5.90104	1	.05>p>.01	.25733
Length of Residence	4.42834	1	.05>p>.01	.22736
Shopping, Trips per week	.47886	1	.5>p>.2	.14517
Farm Size	.72559	1	.5>p>.2	.16823
Farm Consolidation	.18452	1	.7>p>.5	.10911
Full- or Part-time Farming	5.15993	1	.05>p>.01	.34851
Type of Farming (Cash crop, dairy, etc.)	.07858	1	1 >p>.7	.08601
Change to specialization	0	1	1 >p>.7	.02409
Time of farm automation	.64857	1	.5>p>.2	.15610

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.6 : Factors Related to Farmer Families' Selection of Paint and Wallpaper Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-coefficient **
<u>Objective Factors</u>				
Distance	1.31251	1	.5 >p > .2	.16647
Price of Goods	2.27743	1	.2 >p > .1	.19421
Specialized Goods/Services	.18648	1	.7 >p > .5	.08047
Shopping Convenience	3.40512	1	.1 >p > .05	.23158
Attractiveness of market	.30677	1	.7 >p > .5	.12547
<u>Subjective Factors</u>				
Saves Money	8.80420	1	.01 >p > .001	.35834
Saves Time	1.81810	1	.2 >p > .1	.18025
<u>Farmers' Characteristics</u>				
Income	.62330	2	1 >p > .7	.02791
Age	.12606	2	1 >p > .7	.02889
Education	2.03137	2	.5 >p > .2	.11485
Length of Residence	9.63025	3	.05 >p > .01	.24846
Shopping, Trips per week	.77010	1	.5 >p > .2	.13221
Farm Size	.05701	2	1 >p > .7	.02605
Farm Consolidation	1.27400	1	.5 >p > .2	.15592
Full- or Part-time Farming	.55979	2	1 >p > .7	.08212
Type of Farming (Cash crop, dairy, etc.)	.35578	2	1 >p > .7	.06587
Change to specialization	0	1	1 >p > .7	.03546
Time of farm automation	8.35187	2	.05 >p > .01	.31721

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.7 : Factors Related to Farmer Families' Selection of Department Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	.38522	1	.7 > p > .5	.10295
Price of Goods	6.84839	1	.01 > p > .001	.31183
Specialized Goods/Services	.99020	1	.5 > p > .2	.14173
Shopping Convenience	4.36504	1	.05 > p > .01	.26015
Attractiveness of market	.02999	1	1 > p > .7	.05248
<u>Subjective Factors</u>				
Saves Money	4.93674	1	.05 > p > .01	.27315
Saves Time	1.39270	1	.5 > p > .2	.16720
<u>Farmers' Characteristics</u>				
Income	2.89240	2	.5 > p > .2	.18233
Age	1.58776	2	.5 > p > .2	.09664
Education	.01330	2	1 > p > .7	.00893
Length of Residence	3.49158	2	.2 > p > .1	.14459
Shopping, Trips per week	0	1	1 > p > .7	.01881
Farm Size	3.13705	1	.1 > p > .05	.22763
Farm Consolidation	1.11176	1	.5 > p > .2	.14698
Full- or Part-time Farming	.77701	1	.5 > p > .2	.13023
Type of Farming (Cash crop, dairy, etc.)	.13377	1	1 > p > .7	.07434
Change to specialization	.11428	1	1 > p > .7	.09333
Time of farm automation	.07813	1	1 > p > .7	.06387

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.8 : Factors Related to Farmer Families' Selection of Family Clothing Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob*	Cramer's V Or Phi-coefficient **
<u>Objective Factors</u>				
Distance	.05497	1	1 > p > .7	.08032
Price of Goods	7.95011	1	.01 > p > .001	.35093
Specialized Goods/ Services	.37912	1	.7 > p > .5	.11578
Shopping Convenience	1.73597	1	.2 > p > .1	.17372
Attractiveness of market	.66775	1	.5 > p > .2	.13625
<u>Subjective Factors</u>				
Saves Money	6.99010	1	.01 > p > .001	.32269
Saves Time	.22143	1	.7 > p > .5	.10981
<u>Farmers' Characteristics</u>				
Income	.78328	1	.5 > p > .2	.15227
Age	0	1	1 > p > .7	.00384
Education	.99718	1	.5 > p > .2	.10576
Length of Residence	.01031	1	1 > p > .7	.03181
Shopping, Trips per week	0	1	1 > p > .7	.02094
Farm Size	1.10690	1	.5 > p > .2	.16517
Farm Consolidation	.46614	1	.5 > p > .2	.11741
Full- or Part-time Farming	4.84497	1	.05 > p > .01	.28264
Type of Farming (Cash crop, dairy, etc.)	0	1	1 > p > .7	.02647
Change to specialization	.11488	1	1 > p > .7	.10488
Time of farm automation	0	1	1 > p > .7	.02066

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.9 : Factors Related to Farmer Families' Selection of Automotive Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob*	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	21.74145	1	.001 > p > .0	.52503
Price of Goods	3.28534	1	.1 > p > .05	.22235
Specialized Goods/ Services	4.09952	2	.2 > p > .1	.21707
Shopping Convenience	6.63024	1	.05 > p > .01	.30148
Attractiveness of market	.34921	1	.7 > p > .5	.12599
<u>Subjective Factors</u>				
Saves Money	5.65142	2	.1 > p > .05	.25785
Saves Time	9.23094	1	.01 > p > .001	.35328
<u>Farmers' Characteristics</u>				
Income	.86277	3	1 > p > .7	.10135
Age	4.85248	2	.1 > p > .05	.17637
Education	.67024	2	1 > p > .7	.06412
Length of Residence	13.48952	2	.01 > p > .001	.29127
Shopping, Trips per week	2.18634	2	.5 > p > .2	.16038
Farm Size	4.60129	2	.2 > p > .1	.23131
Farm Consolidation	1.95455	2	.5 > p > .2	.15076
Full- or Part-time Farming	5.77039	2	.1 > p > .05	.25607
Type of Farming (Cash crop, dairy, etc.)	1.19615	2	.7 > p > .5	.11726
Change to specialization	0	1	1 > p > .7	.01367
Time of farm automation	4.49782	2	.2 > p > .1	.22608

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.10 : Factors Related to Farmer Families' Selection of Shoe Store In a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob*	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	1.29450	1	.5 > p>.2	.16053
Price of Goods	8.05686	1	.01 > p>.001	.33743
Specialized Goods/ Services	4.69803	1	.05 > p>.01	.27907
Shopping Convenience	3.60768	1	.1 > p>.05	.24007
Attractiveness of market	2.07792	1	.2 > p>.1	.18993
<u>Subjective Factors</u>				
Saves Money	8.05686	1	.01 > p>.001	.33743
Saves Time	1.59484	1	.5 > p>.2	.17344
<u>Farmers' Characteristics</u>				
Income	.78447	1	.5 > p>.2	.13169
Age	1.64223	2	.5 > p>.2	.10100
Education	.09431	1	1 > p>.7	.04632
Length of Residence	2.95268	1	.1 > p>.05	.15254
Shopping, Trips per week	0	1	1 > p>.7	.00262
Farm Size	.10736	1	1 > p>.7	.07708
Farm Consolidation	0	1	1 > p>.7	.03194
Full- or Part-time Farming	.49762	1	.5 > p>.2	.13697
Type of Farming (Cash crop, dairy, etc.)	0	1	1 > p>.7	.02306
Change to specialization	0	1	1 > p>.7	.00408
Time of farm automation	2.62401	1	.2 > p>.1	.20787

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.11 : Factors Related to Nonfarm Families' Selection of Grocery Store in a Particular Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	25.81318	1	.001 > p > 0	.56387
Price of Goods	7.05281	2	.05 > p > .01	.28151
Specialized Goods/Services	1.76725	1	.2 > p > .1	.17314
Shopping Convenience	.79128	1	.5 > p > .2	.12366
Attractiveness of market	.74591	1	.5 > p > .2	.11866
<u>Subjective Factors</u>				
Saves Money	4.88489	2	.1 > p > .05	.23428
Saves Time	1.73895	1	.2 > p > .1	.16826
<u>Non-Farmers' Characteristics</u>				
Income	1.32964	4	1 > p > .7	.08547
Age	7.01125	4	.2 > p > .1	.14360
Education	5.78757	4	.5 > p > .2	.18238
Length of Residence	10.34355	2	.01 > p > .001	.24962
Shopping, Trips per week	4.48349	2	.2 > p > .1	.22197

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.12: Factors Related to Nonfarm Families' Selection of Optometrist in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	19.38320	1	.001 > p > 0	.51700
Price of Goods	1.09292	1	.5 > p > .2	.16896
Specialized Goods/ Services	6.20501	1	.05 > p > .01	.32535
Shopping Convenience	.99802	1	.5 > p > .2	.15117
Attractiveness of market	0	1	1 > p > .7	.07564
<u>Subjective Factors</u>				
Saves Money	1.41832	1	.5 > p > .2	.18157
Saves Time	4.47353	1	.05 > p > .01	.27594
<u>Non-Farmers' Characteristics</u>				
Income	1.98095	1	.2 > p > .1	.20587
Age	19.73611	2	.001 > p > 0	.37817
Education	.93443	1	.5 > p > .2	.10124
Length of Residence	.14418	1	1 > p > .7	.05578
Shopping, Trips per week	.30174	1	.7 > p > .5	.10025

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.13 : Factors Related to Nonfarm Families' Selection of Clinics in a Certain Central Place
(A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	19.15314	1	.001 > p > .0	.50345
Price of Goods	0	1	1 > p > .7	.02373
Specialized Goods/Services	13.31884	1	.001 > p > .0	.42607
Shopping Convenience	2.36989	1	.2 > p > .1	.19905
Attractiveness of market	0	1	1 > p > .7	.03087
<u>Subjective Factors</u>				
Saves Money	0	1	1 > p > .7	.01475
Saves Time	2.16026	1	.2 > p > .1	.18952
<u>Non-Farmers' Characteristics</u>				
Income	3.20188	2	.5 > p > .2	.19760
Age	8.47088	2	.05 > p > .01	.23685
Education	.14105	2	1 > p > .7	.03007
Length of Residence	10.08912	4	.05 > p > .01	.18099
Shopping, Trips per week	.22526	2	1 > p > .7	.05340

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.14 : Factors Related to Nonfarm Families' Selection of Floor Covering Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	.00811	1	1 > p>.7	.05676
Price of Goods	.00030	1	1 > p>.7	.05190
Specialized Goods/Services	2.39724	1	.2 > p>.1	.22616
Shopping Convenience	.07784	1	1 > p>.7	.08224
Attractiveness of market	.02911	1	1 > p>.7	.07443
<u>Subjective Factors</u>				
Saves Money	.37916	1	.7 > p>.5	.11888
Saves Time	.52998	1	.5 > p>.2	.15421
<u>Non-Farmers' Characteristics</u>				
Income	.74491	1	.5 > p>.2	.17550
Age	2.48264	1	.2 > p>.1	.15811
Education	5.29552	1	.05 > p>.01	.22131
Length of Residence	.03810	1	1 > p>.7	.04242
Shopping, Trips per week	.41613	1	.7 > p>.5	.12123

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.15 : Factors Related to Nonfarm Families' Selection of Jewelry Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob*	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	.01476	1	1 >p > .7	.06482
Price of Goods	0	1	1 >p > .7	.03976
Specialized Goods/Services	.20437	1	.7 >p > .5	.12109
Shopping Convenience	0	1	1 >p > .7	.00672
Attractiveness of market	.77528	1	.5 >p > .2	.17094
<u>Subjective Factors</u>				
Saves Money	0	1	1 >p > .7	.04085
Saves Time	.00862	1	1 >p > .7	.10445
<u>Non-Farmers' Characteristics</u>				
Income	0	1	1 >p > .7	.01952
Age	.00094	1	1 >p > .7	.07024
Education	1.40663	1	.5 >p > .2	.13766
Length of Residence	0	1	1 >p > .7	.03902
Shopping, Trips per week	.038844	1	1 >p > .7	.08986

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.16 : Factors Related to Nonfarm Families' Selection of Paint and Wallpaper Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	.13254	1	1 > p>.7	.09283
Price of Goods	2.16857	1	.2 > p>.1	.21817
Specialized Goods/Services	1.45084	1	.5 > p>.2	.19167
Shopping Convenience	.27296	1	.7 > p>.5	.11435
Attractiveness of market	.73052	1	.5 > p>.2	.16116
<u>Subjective Factors</u>				
Saves Money	.94204	1	.5 > p>.2	.16386
Saves Time	.07937	1	1 > p>.7	.09469
<u>Non-Farmers' Characteristics</u>				
Income	.50486	1	.5 > p>.2	.15476
Age	8.79263	1	.01 > p>.001	.27477
Education	.04839	1	1 > p>.7	.04358
Length of Residence	.04771	1	1 > p>.7	.04545
Shopping, Trips per week	.06330	1	1 > p>.7	.07944

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.17 : Factors Related to Nonfarm Families' Selection of Department Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob*	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	0	1	1 > p>.7	.01760
Price of Goods	4.39617	1	.05 > p>.01	.26162
Specialized Goods/ Services	3.76456	1	.1 > p>.05	.24250
Shopping Convenience	.61253	1	.5 > p>.2	.12333
Attractiveness of market	.19214	1	.7 > p>.5	.08627
<u>Subjective Factors</u>				
Saves Money	4.70471	1	.05 > p>.01	.27292
Saves Time	.46417	1	.5 > p>.2	.11476
<u>Non-Farmers' Characteristics</u>				
Income	.01571	1	1 > p>.7	.06236
Age	.33806	2	1 > p>.7	.04486
Education	1.10154	1	.5 > p>.2	.10557
Length of Residence	.17736	1	.7 > p>.5	.05415
Shopping, Trips per week	.00115	1	1 > p>.7	.04340

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.18 : Factors Related to Nonfarm Families' Selection of Family Clothing Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coefficient **
<u>Objective Factors</u>				
Distance	0	1	1 >p>.7	.03355
Price of Goods	2.27725	1	.2 >p>.1	.22479
Specialized Goods/ Services	3.73778	1	.1 >p>.05	.27962
Shopping Convenience	1.64017	1	.5 >p>.2	.22148
Attractiveness of market	1.87705	1	.2 >p>.1	.21272
<u>Subjective Factors</u>				
Saves Money	4.80715	1	.05 >p>.01	.31277
Saves Time	0	1	1 >p>.7	.08364
<u>Non-Farmers' Characteristics</u>				
Income	.02318	1	1 >p>.7	.11099
Age	.01309	1	1 >p>.7	.06618
Education	2.57471	1	.2 >p>.1	.15922
Length of Residence	1.94284	1	.2 >p>.1	.14215
Shopping, Trips per week	0	1	1 >p>.7	.01160

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.19 : Factors Related to Nonfarm Families' Selection of Automotive Dealer in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	10.55332	1	.01 >p>.001	.38069
Price of Goods	.15017	1	.7 >p>.5	.07358
Specialized Goods/Services	3.71905	1	.1 >p>.05	.25044
Shopping Convenience	.42776	1	.7 >p>.5	.10631
Attractiveness of market	0	1	1 >p>.7	.06984
<u>Subjective Factors</u>				
Saves Money	.02182	1	1 >p>.7	.05151
Saves Time	.96230	1	.5 >p>.2	.14075
<u>Non-Farmers' Characteristics</u>				
Income	5.08678	1	.05 >p>.01	.29680
Age	1.57790	2	.5 >p>.2	.10057
Education	1.46187	2	.5 >p>.2	.09499
Length of Residence	.33470	2	1 >p>.7	.04603
Shopping, Trips per week	.00707	1	1 >p>.7	.04194

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

TABLE C.20 : Factors Related to Nonfarm Families' Selection of Shoe Store in a Certain Central Place (A Chi-Square Test)

Factors	Chi-Square	df	Obsev. Prob *	Cramer's V Or Phi-Coef-ficient **
<u>Objective Factors</u>				
Distance	.23656	1	.7 >p >.5	.17395
Price of Goods	1.55461	1	.5 >p >.2	.19285
Specialized Goods/Services	4.07477	1	.05 >p >.01	.28813
Shopping Convenience	1.94825	1	.2 >p >.1	.21690
Attractiveness of market	1.87705	1	.2 >p >.1	.21272
<u>Subjective Factors</u>				
Saves Money	1.27690	1	.5 >p >.2	.20420
Saves Time	.49069	1	.5 >p >.2	.21018
<u>Non-Farmers' Characteristics</u>				
Income	.03200	1	1 >p >.7	.11642
Age	0	1	1 >p >.7	.05087
Education	.57276	1	.5 >p >.2	.09077
Length of Residence	1.57379	1	.5 >p >.2	.13290
Shopping, Trips per week	0	1	1 >p >.7	.10148

*The critical value of alpha for rejecting the null hypothesis and accepting the alternative hypothesis was assumed at .05.

**Cramer's V was selected for chi-square tests with more than one degree of freedom; the Phi-coefficient was used for tables with having one degree of freedom.

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