A Comparison of the Functions and Population Size of Central Places in Snohomish County, Washington and Cache County, Utah

Richard L. Dixon

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A COMPARISON OF THE FUNCTIONS AND POPULATION SIZE OF CENTRAL PLACES IN SNOHOMISH COUNTY, WASHINGTON AND CACHE COUNTY, UTAH

by

Richard L. Dixon

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Social Science

UTAH STATE UNIVERSITY
Logan, Utah

1968
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ABSTRACT

A Comparison of the Functions and Population Size of Central Places in Snohomish County, Washington and Cache County, Utah

by

Richard L. Dixon, Master of Science

Utah State University, 1968

Major Professor: Mr. Evan B. Murray
Department: Social Science

A study of the central places in Cache County to determine their population and function was made during the academic year 1967-1968. The purpose was to determine if the function of places in Cache County, Utah of a given population was the same as the function of places in Snohomish County, Washington of the same population.

The data for Snohomish County, Washington were taken from a report on the central places in that county prepared by Brian J. L. Berry and William Garrison of the University of Washington Geography Department.

Evidence is presented to support the conclusion that these two areas are very similar in geographic setting and general economy. Evidence is also presented that the central places of similar population size do not perform the same functions. A central place in Cache County must have a larger population in order to support a given function than is necessary in Snohomish County. Further evidence is presented to support the conclusion that lack of a complementary region for the Cache County central places and presence of complementary regions for
Snohomish County central places is the cause of the differences found in function of the places.
CHAPTER I
INTRODUCTION

To the casual observer driving through settlements in Cache County, Utah the business districts seem small and incomplete when compared to the settlements' populations. A person's past experience has provided him with a frame of reference which renders a stereotype town once the population is known to him. Built into this image of the settlement are specific businesses and services one would expect to be present. The purpose of this paper is to present some empirical evidence to test the notion that Cache County settlements have fewer businesses and services than one would expect given the population and particular frame of reference.

Each individual has a unique frame of reference. The dominant geographic environment, both physical and cultural, that influences the evolution of an individual's frame of reference must be taken into consideration. The geographic environment dominant in the evolution of the writer's frame of reference is that along the east side of the Puget Trough. Generally this region consists of an inundated valley, Puget Sound, with tributary stream valleys flowing in from the Cascade Mountains to the east. The flood plains and deltas of these streams have produced a nearly continuous coastal plain from Olympia in the south to Bellingham in the north, some 150 miles distance, interrupted only by low hills. These hills are the lateral moraines of Pleistocene piedmont glaciers that flowed through the now present stream valleys, and they
tend to segment the coastal plain. Each of these segments is generally referred to as a valley, named for the major stream flowing in it.

The Snohomish Valley is an example of one of these regions. Again very generally, the counties of the Puget Lowlands consist of one of these segments of coastal plain, a section of the western slope of the Cascade Mountains, and are bounded on the north and south by the crest of the low hills mentioned earlier.

It now seems reasonable to suggest a comparison of one of these counties in Washington (from the writer's frame of reference) to Cache County, Utah, the region in question. The comparison will be to determine whether or not settlements of comparable population within the two counties do in fact differ in the number of businesses and services. A descriptive study of Snohomish County, Washington done by Brian J. L. Berry and William Garrison of the University of Washington Geography Department will be used for this comparison.

The Berry-Garrison study classifies settlements according to their central place functions and arranges them in a hierarchical system. This is a valuable asset of the study because it eliminates special cases for the existence of a settlement, which will be explained more fully in the discussion of Central Place Theory. The functions a settlement performs for those it serves determines the basis for its position in the hierarchy of settlements. After the hierarchy is established for Cache County it will be compared to the hierarchy for Snohomish County to see if there is a difference in the population of places with the same number of functions or if this notion has evolved through over-generalizing on the part of this writer.

This paper will include four parts beyond this introduction:
Chapter II: A discussion of the similar geographic aspects of Snohomish County, Washington and Cache County, Utah.

Chapter III: A discussion of Central Place Theory as a basis for the hierarchy used in the Snohomish County study and for this comparison.

Chapter IV: The Berry-Garrison model and its application to Snohomish County, Washington and Cache County, Utah and the hierarchy of the central places in these counties.

Chapter V: A comparison of size-function of places in the two counties and possible reasons for any differences that might be observed.
CHAPTER II

A COMPARISON OF THE GEOGRAPHIC CHARACTER OF
SNOHOMISH COUNTY, WASHINGTON AND
CACHE COUNTY, UTAH

There is much about these two counties that is similar. They are both bounded by natural features separating them from adjoining counties with the exception of the north boundary of Cache County which is a compound political boundary with no physical boundary—the Cache County and Utah-Idaho line which corresponds to the forty-second degree north-latitude parallel. The major mountain ranges forming the eastern boundaries—the Cascades and Wasatch for Snohomish and Cache, respectively—each have all-weather highways over passes to the east. Each county's largest city is located at the western end of the pass highway—Everett, Washington and Logan, Utah. To the north in Snohomish County there is a low ridge separating it from Skagit County with easy access via several county roads and Interstate Highway 5. Cache County has no barrier, as mentioned earlier, and is connected to Idaho by a highway that is part of the interstate system. To the south, highways connect the two counties to each state's largest city—Seattle, Washington and Salt Lake City, Utah. In both cases the county is separated from the city by a low divide which is of greater importance in the case of Cache County than Snohomish County. The driving distance time from central Cache County to Salt Lake City is about 1.5 hours whereas it is about .5 hours from central Snohomish County to Seattle—distances of 90 and
40 miles, respectively. The western part of Cache County is bounded by mountains and low hills with roads connecting points west. Snohomish County is bounded on the west by Puget Sound with ferry boat connections to points west.

The geology of the two counties is very similar in its general outward manifestations. The high mountains are metasedimentary with glacial features forming low hills in Snohomish County. The counterpart in Cache County is the bench land produced by Lake Bonneville. These features consist of gravelly loams and gravelly clay loams, the former being predominant in Snohomish County. Each county, essentially a series of river valleys with one much larger than the rest, has a considerable deposit of alluvium forming an extensive flood plain which is the major soil type for the agricultural activities of the regions.

Dairying, with some field crops such as peas, corn, and berries, occupy most of the agriculture in Snohomish County. In Cache County, dairying, sugar beets, and alfalfa are the primary agricultural pursuits.

In order for agriculture to be practiced in Snohomish County the land had to be cleared of the forests. In the lower land, which was wet and in need of drainage, the predominant trees were western red cedar, hemlock, alder, and birch; on higher ground were Douglas fir and spruce. In Cache County, the majority of the land was originally sagebrush except near the rivers where tall grasses were in abundance. Here again drainage was necessary in order to make this land produce on a commercial basis, and the upland needed irrigation water which is supplied by the streams issuing from the Wasatch Mountains to the east.

The mineral resources within both regions are of minor importance, being mostly construction materials—gravel, clay, sand, and some
limestone. Hydro-electric development is limited to relatively small streams but does contribute to the power requirements of both counties.

Two outstanding differences exist in the comparison of the two counties. One is the timber produced in Snohomish County. The Everett mill of the Weyerhauser Timber Company is ranked third in the world in production and much of its timber comes from the western slopes of the Cascades in Snohomish County; but many other small mills also operate in the county. Cache County has some Douglas fir in the Wasatch Mountains which is of marketable quality, but of minor importance to the economy as a whole.

The other obvious difference in the two counties is the climate, which is the major contributing factor to the difference observed in the timber production. Snohomish County at sea level is an example of a marine west coast climate, changing with elevation to a tundra and polar climate in the Cascade Mountains. Cache County is in its lower elevations a steppe climate changing with elevation in the Wasatch Mountains to taiga. A tabulation of statistical data gives more specific information on the climatic comparison. (See Table 1.)

To summarize, the geographic characteristics of the counties seem to present many more similarities than differences. To the tourist who passes through both of these regions there would probably seem to be much more diversity than is evident in this paper. This discrepancy is surely due to the manifestations of the climatic differences visible in the landscape. The marine west coast climate is typically cool, humid and cloudy. The rainfall is evenly distributed throughout the year and the evaporation rate is extremely low. The net result is a soft, wet, shaggy, green topography. On the other hand, the steppe climate has a cold dry
winter and a hot dry summer with an evaporation rate that far exceeds the precipitation from April to October. The result of this climatic type is short grass and sagebrush valley floor with scrub brush in the foothills and forested mountains, free of underbrush.

Table 1. Climatic data for Cache and Snohomish counties

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Data in various units</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Cache County</td>
</tr>
<tr>
<td>Mean July temperature</td>
<td>71° F</td>
</tr>
<tr>
<td>Mean January temperature</td>
<td>24° F</td>
</tr>
<tr>
<td>Mean frost-free season</td>
<td>165 days</td>
</tr>
<tr>
<td>Mean annual precipitation</td>
<td>24-32 in.</td>
</tr>
<tr>
<td>Mean annual snow depth</td>
<td>65 in.</td>
</tr>
<tr>
<td>Record high temperature</td>
<td>99° F</td>
</tr>
<tr>
<td>Record low temperature</td>
<td>-20° F</td>
</tr>
<tr>
<td>Month of maximum precipitation</td>
<td>January</td>
</tr>
<tr>
<td>Month of minimum precipitation</td>
<td>July</td>
</tr>
</tbody>
</table>

This short geographic sketch of the two regions and the accompanying maps (see Figure 1) are intended to give the reader a little better idea of the physical setting for the ensuing comparison than might otherwise exist.

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Figure 1. Maps of Snohomish and Cache counties.
CHAPTER III

CENTRAL PLACE THEORY

For years, sociologists, geographers, and economists have been doing studies on the location and functions of cities. Many of these studies have indicated that cities have a logical pattern to their location. Sir William Petrie, an historian, in writing about ancient Egypt noted the remarkable similarity between the distance from one city on the Nile Delta to the next city (21 miles) and the distance between cities in Mesopotamia (20 miles). He reasoned that grain storage was the function of the city and that it was impractical to transport it farther than 10 miles from where it was grown to where it was to be stored. ²

Certain physical geographic features such as mountain passes, intersecting natural transportation routes, rich soil, river fords; historical situations such as boundary disputes and mission outposts; economic factors such as location of raw materials for industry and location of banking firms; sociological developments such as industrial culture and ethnic and religious group settlements have all been proposed as having influenced to a greater or lesser extent the location of cities. There has been no theory which can be used as a framework for evaluating all these factors and assigning to each the emphasis it has exerted in the formation of a particular city. All attempts to formulate a general theory have integrated the factors so that their sum will be the total cause for the existence of a city; and depending on the variations

within each factor will be applicable to any city being studied. These theories have proven invalid for two reasons: (a) every city has more functional value than the sum of its parts, and (b) some cities are in existence for no apparent logical reason. Apparently the social scientists were trying to deal with the factors as entities and not as interrelated parts of an underlying scheme, which is itself a factor in the city's total development.³

In 1933, Walter Christaller, a German scholar, proposed the term "Central Place Theory." In his book Central Places in Southern Germany Christaller states that there are laws determining the location of cities just as there are economic laws which determine the life of an economy.⁴

Since its original publication there have been many criticisms and commendations of Christaller's book. Some scientists have expanded the original theory and some have reformulated it—all agree there is much to be gained from its application. Many German geographers point out that the area Christaller studied (from which his theory evolved) is an exceptional place and all geographers and sociologists agree that there are exceptions to the specific examples he cites, but they further agree that the theory is applicable in a great many areas.⁵ Very recently, Brian Berry and William Garrison have pointed out that no one expects

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the conditions of a theoretical model to be met perfectly in the real world and that it is the researcher's problem to investigate the underlying equilibrium conditions in spite of the innumerable variations that exist.\textsuperscript{6}

A "central place" is a settlement of human beings, commonly referred to as a city, town, village, or hamlet. For the remainder of this paper, the term "place" shall be used in any case. The purpose of a place is to provide goods and services to the region for which it is the center. It has been pointed out that places are becoming more and more service centers; whereas, previously these places were primarily industrial centers.\textsuperscript{7}

The goods and services provided for a region by a central place are generally referred to as the central functions of the place and in this paper will be referred to as the functions of the place. Here it should be pointed out that a place may have functions that are not central functions. A mining town will serve as a service center for the mine and exist for that function alone or it may also serve as a central place providing central functions for the surrounding region.\textsuperscript{8}

The region that surrounds the place is called the complementary region. Within this region reside the people who partake of the functions provided by the place. It is conceivable that the region could


\textsuperscript{8}Christaller, p. 16.
consist of that area within the legal limits of the place; this is, however, not usually the case.  

For the purpose of establishing a theoretical model, it is necessary to describe the idealized landscape where this model will exist. The following list will fulfill this description:

1. An unbounded plain with soil of equal fertility everywhere and an uneven distribution of resources.
2. An even distribution of purchasing power and population.
3. A uniform transportation network in all directions so that all central places of the same type are equally accessible.
4. A constant range of any one central good, whatever the central place from which it is offered.  

Within this landscape there are economic principles operating that determine the purchasing behavior of the population. These are as follows:

1. A maximum number of demands for the goods and services should be satisfied.
2. The incomes of the people offering the goods and services should be maximized.
3. Distances moved by consumers to purchase the goods and services should be minimized (i.e., purchases are made at the closest point).
4. The number of central places should be the minimum possible.  

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9 Ullman, p. 854.
11 Ibid., p. 223.
The size of a complementary region is determined by the functions it provides and the distance purchasers will travel to avail themselves of these functions. The distance a person will travel to purchase a central good or service is called the range of the good or service and will be referred to in this paper as the range of the function or simply the range.

The range of a function has limits that operate when we consider the range as a parameter of the complementary region. The ideal limit of the range is the distance a person will travel to purchase the good and beyond which the cost of the good (purchase price plus travel cost) cannot be afforded by the purchaser. This limit of the range, sometimes referred to as the upper limit, is the radium of the complementary region, the distance from the central place where the demand becomes zero. Another limit of the range is the radius of the region that must be included for there to be enough purchasers to support a particular function. If the upper limit and lower limit are the same, then there are just enough purchasers within the maximum distance one is willing to travel for a particular function to support that function's existence. In this case, there will be no economic profit produced by the function. If, however, the upper limit is greater than the lower limit (more purchasers within the maximum range than are necessary to support a function), there may be an economic profit. In this case, the existence of economic profit depends on a comparison of the total number of purchasers and the threshold population for the function. The threshold population is that number of purchasers necessary for the support of a particular function. If the number of purchasers within the upper limit is greater than the threshold population for one element of a
function and not great enough for the support of two, then there will be economic profit for the one. Obviously if the upper limit of the range includes people equaling two times the threshold population, then the same situation exists as in the case where the upper limit equals the lower limit.

The remaining limit to the range of a function is the real limit. In order to define this limit a hypothetical situation can be employed to show how this limit evolves.

Let us suppose there is a region with the landscape characteristics listed previously. The population is evenly dispersed and all have equal purchasing power. The assumption is that each has the same demand for goods and equal ability to pay, i.e., the range of a function for any one of these purchasers is the same as for any other. The population density is such that no matter how the upper limit or the complementary region is drawn it will include more people than the threshold population for the function but not two times the threshold population. The problem is: Where within this region will the central places providing this function be located?

For simplicity, consider where three central places will be located in order to best serve the population of purchasers. It is readily apparent that if three places are to be spaced so that each is equidistant from the other, line segments connecting their points must form an equilateral triangle. (See Figure 2a.) This gives the relative position of the places in space but does not indicate the distance between the places. If we assume the distance to be the upper limit of the function of the places, then the purchasers who live within the triangle will have three places to provide this function and the range
beyond the triangle will be less than it might be and will therefore not satisfy the economic criterion set forth previously. (The maximum number of demands for goods and services shall be satisfied with the minimum number of places as shown in Figure 2b.) It is now clear that the places must form a triangle and must be close enough together so that all purchasers within the triangle are within the upper limit and far enough apart so that the least amount of overlap of the service area circles exists. This will be accomplished when the perimeter of the service area circles all intersect at the point at the center of the triangle. (See Figure 2c.)

\[
\overline{AB} = \overline{BC} = \overline{CA} = \text{upper limit of range}
\]

\[
\overline{AP} = \overline{BP} = \overline{CP} = \text{upper limit of range}
\]

Figure 2. Distribution of places and upper limit of range.
It can now be seen that the distance from point $P$ to any of the central places is the upper limit of the range of the function. It is now necessary to compute the distance from one place to the next. By using the range as the hypotenuse of a $30^\circ - 60^\circ$ right triangle, a ratio of $1, 2, \sqrt{3}$ for the sides is obtained. (See Figure 3a.) The ratio of line $BD$ to $BP$ is $\frac{\sqrt{3}}{2}$ or $0.87$ and line $BD$ is half the distance $AB$. Therefore given: $BP$ (the upper limit of the range), $AB = 2 \times BD$, $BD = BP \times 0.87$; then $AB = 2(BP \times 0.87)$. From this it can be seen that some overlap will exist midway between the places. (See Figure 3b.) The purchasers within this zone will find either of two places within the range of the function. The assumption was made above that the goods will be purchased at the closest point to minimize cost. Therefore those purchasers in the area of overlap will be divided evenly between the respective closest points. (See Figure 3c.) The real limit of the range is half the distance to the next place that provides the same function, i.e., in the example just stated, the real limit of the range of the function is distance $BD$.

With regard to the triangular arrangement of population distribution, it has been demonstrated that the pattern in Figure 4a is not as efficient a distribution for an area as Figure 4b which at this time is considered to be the most efficient distribution possible. Until now it has, for the sake of simplicity, been expedient to restrict the discussion to three places and one function with one range. However, one of the principles of "Central Place Theory" is that there exists an unbounded plain; and further, the plain has evenly distributed

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12 Christaller, p. 67.
Figure 3. Example of a real limit of a range.

Figure 4. Two types of dispersed settlement.
population. It is also nearer to reality to deal with many functions with various ranges.

In studies considering functions, the range of functions, and the populations of the places where these functions are located, it has been found that there is a definite correlation between city size and the functions found therein. Further, it has been determined that these functions are grouped; i.e., if one function is found in a city, others in the same group will also be in evidence. The most conclusive study of this sort and certainly the most statistically rigorous was done by Brian Berry and William Garrison at the University of Washington. Results to the .95 level of confidence indicated that there was a grouping of functions and close relationship between population and functions. 13

It is apparent on the intuitive level that there will be distinct breaks in the groups of functions since threshold levels of functions have been found to exist. If it takes a certain number of purchasers to support a particular function and this function is within a group, it can be shown that all the functions within the group have approximately the same threshold level and will be found in places with similar populations. 14 It is now common to find places and functions grouped and arranged in a hierarchy from those with the lowest to those with the highest range and threshold population.

Concerning the relationship between the population of a place and the level in the hierarchy of functions found in the place, the writer


14 Ibid., p. 150.
of this paper feels the absolute population of a place will vary with the region under investigation. This is the reason for the comparative study in this paper.

Of primary interest to those who can make use of Central Place Theory is the possibility of determining where places of various sizes should be located. The city planner must know where a particular function should be located within a central place. This contributes greatly to zoning practices and planning codes. It is obviously of little use to plan urban renewal and new centers if those doing the planning are unaware of the natural forces which will play a part in the success of the plans. The foundation for the areal arrangement of places within the central place model has been stated previously—the even distribution of population (Figure 4b) and the equilateral triangular arrangement of the places (Figure 2a).

How will the hierarchy of places fit the distribution of lowest level central places given in Figure 5? In order to answer this question, the previously stated criterion must be met. Each of the lowest order places has a complementary region that is the shape of a hexagon (see Figure 3c and Figure 6a). A hexagon includes six equilateral triangles. It can now be seen in Figure 6b that the six outside places form a hexagon around the center place. This hexagon is the boundary of a complementary region of the next highest group of functions in the function hierarchy. The center place serves the complementary region indicated level "A" function just as the other level "A" places do and it also serves the complementary region indicated "B" type function with functions of the next higher level in the hierarchy. It must be remembered that the hierarchy is based on the range of the functions and the
increased size of the hexagon is proportional to the increase in range. In Figure 6c the progression is just the same as in the preceding situation; another level of central place develops, level "C." It is extremely important to note again that this place is not only a new C-place with the "C" type complementary region, but also a B-place with a "B" type complementary region and an A-place with an "A" type complementary region. What is being demonstrated here in a very systematic way is this: A person living at point P (Figure 6c) will purchase goods of function level "A" (groceries) at place Q, goods of function level "B" (drugs) at place R, and goods of function level "C" (an automobile) at place S. A person living at place R may purchase both A and B level goods in that place because it has both A and B level goods, since it is both an A and B place, but not C type goods. A person living in place S can purchase A, B, and C type goods, because place S is at the same time an A, B, and C place. It is important to note that place S, even though it is a large city, does not attract purchasers for its level "A" type functions from any larger complementary region than does any place that is strictly a type A place.

![Diagram](image)

Figure 5. Most efficient arrangement for dispersed settlement.

It is possible to determine the set of ranges that will exist within a particular place of a known level in the hierarchy of places and to
Figure 6. Hierarchy of places in the theoretical hexagonal pattern.
compute the distances between each place of the hierarchy. This requires giving each function a range in miles and by empiric means determining in which place the groups of functions exist. Once this is accomplished it is possible to take the lowest order function (the one with the shortest range in miles), multiply this number by $\sqrt{3}$ and get the highest range for the place. It is not the purpose of this paper to go into all of the details for using this theory as a research tool but rather to explain enough so that the reader can see its value to any social scientist interested in settlement patterns.

The theoretical aspect of this material may seem to put it so far from reality that it is of no importance; but as stated before, this pattern is a starting place and all of the other variables which influence settlement must be added to it in order to approximate reality. Many times, science has found a general principle that explains numerous phenomena which had originally been explained by separate principles. Most often, these general principles are contrary to "common sense" and they encounter resistance because they disturb previously held conceptions.

Central Place Theory has provided the basis for the study of the settlement of Snohomish County by Berry and Garrison and they have established a hierarchy of settlements there. In the following chapter, the objective is to take the Berry-Garrison model and inject data from Cache County, Utah to see if there is a difference in population size for settlements with the same function.

\footnote{Ibid., p. 149.}
CHAPTER IV

THE BERRY-GARRISON MODEL AND ITS APPLICATION TO SNOHOMISH COUNTY, WASHINGTON AND CACHE COUNTY, UTAH, AND THE HIERARCHY OF THE CENTRAL PLACES IN THESE COUNTIES

Central Place Theory is concerned with the spatial distribution of settlement, and bases this distribution on the range of goods and services. In the Snohomish County Study, the concern is not so much with the pattern of distribution but more with the grouping of settlements based on the functions they perform. Each settlement serves a function which is to provide goods and services, and the range of the function varies, as discussed in Chapter III. Functions of similar range are found in settlements of similar population. The variations in population are within the limits set by the threshold population of the function. The important aspect of this in the present paper is the establishment of a relationship of population of a settlement to the function it performs. Berry and Garrison have done this for one area and one would expect it to hold for other similar areas.

In their study of Snohomish County, Berry and Garrison use 33 places in the county for the hierarchy. Several small places near another county boundary which were part of another hierarchy were excluded, as was Everett, a city of c. 40,000 population. Everett is the county seat of Snohomish County and is the dominant urban center in the region. Everett
was left out for convenience in the statistical comparison; i.e., on a graph which has a population as one parameter, one of the coordinates would have to be so finely divided that the other places on the same graph would not show differences of significant importance. This problem would, in fact, be true in all respects handling the data used in these kinds of studies.

The sources of the data for the Snohomish study are not available in the publication in which it appears, but the information is arrayed in tables, one with the population and total number of functions in the town on the X-axis and the name and threshold population on the Y-axis. The second has the name of another type function, attribute (which is defined later in this chapter) on the X-axis and the names of the places, in order of total number of functions, on the Y-axis. Both of these tables demonstrate the hierarchy of places based on functions they perform.

For the present paper and for evidence to support the hypothesis that the places in Cache County have functions much farther down the hierarchical order than the population would indicate, the threshold populations of variates and the number of attributes per place of a given population are of primary importance. These figures allow comparisons from one county to the other of places of similar populations and the functions which they perform.

For the Cache County study, it was necessary to collect data that would yield threshold populations for variates and total numbers of attributes that performed the same functions as in Snohomish County. Some of both of these lists were not present at all or were found in only one place in Cache County, so they were dropped from the list. All
of the functions dropped can be found in the city of Logan, the Cache County seat, a city of c. 18,000; but this place was eliminated from the study for the same reasons Everett was left out of the Snohomish County study.

The data were collected by counting the number of functions present in each population center in the county. The preliminary count was made by using the telephone directory for business listings. The second count, a survey of the tax rolls for the county, revealed some businesses that did not have telephones. A third count was made by personal interviews with residents and officials of the places included in the study.

The statistical methods and rationale for the use of particular functions can be found in the complete study by Berry and Garrison and are not of particular significance here.

Figures 7 and 8 are graphs of the data collected in Snohomish and Cache Counties.

Following is an explanation of the difference between a function called an attribute and a variate:

A variate is a function within a settlement that may have more than one unit of business providing the goods or services of the function. An attribute is a function that is usually performed by one unit and either exists or does not. In the Snohomish County study, these functions were accounted for in this way and if more than one unit did in fact exist, it is not evident from the data.

These data are compared by using the threshold populations of the variates, the value of $P$ (population) for $N = 1$ ($N$ is number of units of a function). The threshold population of a function is determined by
Figure 7. Graph of threshold populations.
Figure 8. Graph of population of places and number of attributes.
plotting all the settlements' populations and functions on a scatter diagram and drawing a best-fitting curve so that $P$ for $N = 1$ can be interpolated. The bar graph (Figure 7) is the result of variates in Cache and Snohomish counties. These threshold populations have been determined by drawing best-fitting curves on scatter diagrams with population and number variates as the parameters for these scatter diagrams. The second graph (Figure 8) is a comparison of the population of places in the two counties and the number of attributes found in them. This second graph has both the absolute numbers for each place and its attributes and a best-fitting curve for all places in each county.
CHAPTER V

RESULTS OF THE COMPARISON AND POSSIBLE REASONS FOR DIFFERENCES OBSERVED

The two graphs in Chapter IV show definite differences in the functions of places in Cache and Snohomish Counties. These differences support the hypothesis that the town of a given population in Cache County will not have the same functions as a town of comparable population in Snohomish County. The threshold populations for variates are particularly outstanding in this regard. In the case of the attributes, the distinction is not so great. The reason for this difference is apparent when a comparison is made of the lists of activities that comprise the two groups. As stated in Chapter IV, the variates may exist in multiple units within a place, whereas the attributes usually do not. Generally the variates are businesses whose number and very existence are determined by the population of the region that support it. This is the significance of the threshold population of variates.

The attributes on the other hand exist for the most part in any population settlement whether large or small. The range in population is much greater for changes in the number of units of a given attribute than it is for the number of units of a variate. An example of an attribute is a water supply system which exists as one unit in a town of 400 population or in a town of 3,000 population, but filling stations (variates) will vary greatly in number in towns of these populations. The assumption here is that when we compare threshold populations of separate regions, the individuals who comprise these regions have similar
buying power. It does very little good to state the threshold population for a service station if the people within that population lack the material wealth to own automobiles and use a service station. In the following pages, evidence is presented to support the validity of this assumption. This evidence indicates that there is no significant difference in the buying power of the average person of the regions being compared.

The best-fitting curves on the attribute graph do indicate a higher number of attributes in towns of a given population in Snohomish County than in Cache County. An extrapolation of the curves would indicate that this difference increases at an increasing rate with population.

What appeared at the intuitive level to be a difference in towns of distant but similar regions has been born out by empirical evidence. It may seem enough to draw this conclusion and end the paper here, but for the reader who is not familiar with the two regions used in this study some further comments about settlement patterns may be appropriate.

A study of the United States Geologic Survey topographic maps, scale 1:24000, for the places mentioned in this paper gives an indication of population distribution. On maps of this scale the individual houses in existence outside the city limits, at the time of the aerial photographs from which the maps were made, are shown as small black squares. This indication of population distribution clearly shows dispersed settlement around the Snohomish County towns and practically no dispersion of population outside the towns of Cache County. See Figures 9 and 10 for examples of this distribution. The town of Monroe in Snohomish County has a considerable number of houses outside the city
Figure 9. Topographic map of Monroe, Washington.
Figure 10. Topographic map of Wellsville, Utah.
limits. In the Cache County example, Wellsville, there are only seven houses located outside the city limits.

It now becomes evident that no complementary region exists for towns in Cache County as does exist in Snohomish County. Stated another way, all of the people served by a particular function of a town in Cache County live within the town; whereas, in Snohomish County only a fraction of the people served by the functions of the town live within its municipal limits. If one again refers to the maps of the two towns, Monroe and Wellsville, a count reveals approximately 275 houses outside of the limits of Monroe and only 7 outside the limits of Wellsville.

Given the average number of people per family—3.9 for Snohomish County and 4.3 for Cache County—16—the total number of people in the area shown outside the city limits of Monroe is 1,072 and outside the city limits of Wellsville is 30. The area included for the count was purely arbitrary, but since the scale of the maps is the same and the towns are similarly situated within the area chosen, it is assumed the sample is good.

If the population figure 1,072 is added to the census population figure for Monroe (1,685) to give some indication of the number of people who support the functions of Monroe, the total is 2,757. If a comparison is based on census population figures and functions performed by towns, Wellsville, Lewiston, and Hyrum in Cache County are expected to perform functions comparable to Monroe in Snohomish County because they all have comparable populations. If, however, the figure 2,757 for the population of Monroe is used, which includes at least some of

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Monroe's complementary region, Monroe is no longer comparable with towns in Cache County having populations of from 1,200 to 1,800, but must be compared to a town of closer to 2,700 population.

Referring again to the attribute graph (Figure 8), it can be seen that a town of 1,700 population in Snohomish County has the same number of attributes as a town of 2,500 in Cache County, which is consistent with what is expected when the population of the complementary region is added to the population of the town as was done with Monroe.

To further check the consistency of what has been said, it is possible to count the number of variates in Monroe (population 1,684, 56 variates) and compare this to a total of 16 variates for Lewiston, Cache County (population 1,533), then add the population in Monroe's complementary region to its official census population to total 2,757 and compare it to Smithfield (population 2,383, 46 variates), a much closer comparison than Lewiston.

It is now clear that the functions a town performs are comparable in Snohomish County and Cache County if the census population is the criterion for choosing the Cache County town and census plus complementary region population is the population figure used for the Snohomish County towns in the comparison.

Another factor mentioned earlier in this chapter that might be considered a determining influence when comparing the number of businesses per town per capita is the amount of money available per capita per business. If, when comparing the total amount of money spent per person in the retail trade it is found that there is a great discrepancy between Cache County and Snohomish County as a whole, then one might suspect that the general wealth of the counties could account for the differences
in number of businesses per capita per town. This, however, is not the case. For the counties as a whole, the per capita retail sales in Cache County is $1,218.50 and in Snohomish County is $1,295.85, a difference of $77.35, which can be considered insignificant in regard to the general wealth of the counties. Further evidence to support the idea that these counties are equal in wealth, consider a comparison of the total of time deposits in banks and savings and loan companies: Cache County's total is $977.55 per capita, while Snohomish County's total is only $726.10 per capita. Other data such as automobile purchases per capita and income per retail business show this same close correlation (see Table 2 for details).

The evidence which supports the conclusion that the lack of a complementary region for towns in Cache County accounts for the difference in the functions of these towns when compared to towns of equal population in Snohomish County is summarized below:

1. A town in Cache County has fewer businesses and services than the same sized town in Snohomish County.

2. When the population found in the complementary region of a town in Snohomish County is added to the population of the town and this figure is taken as the town's population and compared to a town of like population in Cache County, the number of businesses and services within these towns is found to be quite comparable.

3. By referring to the attribute graph, one may observe that a town with a given number of attributes will have a different population for each county; however, when complementary region population is added

17 Ibid.

18 Ibid.
Table 2. Comparison of buying power for Cache and Snohomish Counties

<table>
<thead>
<tr>
<th>Item being compared</th>
<th>Cache County</th>
<th>Snohomish County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income/retail business/year</td>
<td>$147,324.00</td>
<td>$139,291.00</td>
</tr>
<tr>
<td>Retail sales per capita</td>
<td>1,218.50</td>
<td>1,295.85</td>
</tr>
<tr>
<td>Demand deposits in banks per capita</td>
<td>414.48</td>
<td>396.41</td>
</tr>
<tr>
<td>Time deposits in banks per capita</td>
<td>644.57</td>
<td>436.31</td>
</tr>
<tr>
<td>Deposits in Savings and Loan per capita</td>
<td>332.98</td>
<td>289.79</td>
</tr>
<tr>
<td>General merchandise purchased per capita</td>
<td>205.29</td>
<td>103.11</td>
</tr>
<tr>
<td>Food store purchases per capita</td>
<td>242.17</td>
<td>378.74</td>
</tr>
<tr>
<td>Automobile purchases per capita</td>
<td>207.55</td>
<td>217.77</td>
</tr>
<tr>
<td>Number of people per employed person</td>
<td>2.97</td>
<td>3.01</td>
</tr>
<tr>
<td>Number of employed persons per family</td>
<td>1.4</td>
<td>1.29</td>
</tr>
<tr>
<td>Ratio of farm families to non-farm families</td>
<td>1:4.6</td>
<td>1:18.3</td>
</tr>
</tbody>
</table>
to the Snohomish County town, it becomes comparable in population and function to a town in Cache County.

4. When the total number of businesses per capita in the comparison counties is considered, the difference is insignificant.

It is not the purpose of this paper to discuss why there are no complementary regions for Cache County towns even though some mild controversy does exist. Cache County was originally populated by members of the Church of Jesus Christ of Latter-Day Saints, who were directed by their leaders to settle in villages. These villages generally follow the plans for the City of Zion, which is quite specific about the layout of the village and the residence of its population. There was and still exists considerable reason for a village-type settlement. There is not total agreement on why the village system was used, was successful, and still persists—but the fact is, it does exist. Some attribute this pattern to physical environmental forces and protection requirements, while others place more emphasis on the religious devotion of the settlers and their desire to continually build following the plans for the City of Zion.

A very practical point which confronts one when considering the conclusion reached in this study is that towns in Cache County, and probably all of Utah, are not comparable to towns in the rest of the nation. For example, when city planning or urban renewal is being conducted, consulting national statistics for ideas about the size of a town's central business district is useless. Towns in this region just

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don't need as large a central business district as towns of the same population in other regions of the nation. Provo, Utah, population 36,147 and Everett, Washington, population 40,304 are comparable examples. The Chamber of Commerce in Provo may wonder why Provo has only 45 grocery stores when Everett has 95, and may endeavor to encourage new stores to build, based upon the comparison of the cities' populations. Yet when the total sales by these grocery stores are compared, the results are extremely close—$247,000 per store in Provo and $245,000 per store in Everett. A well-developed complementary region exists for Everett—vast areas of suburbs not in the city limits—whereas only minor evidence of this is noted for Provo. It will be interesting to see if population pressure and the desire for suburban living will work together to create a complementary region for the Mormon village.

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BIBLIOGRAPHY


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