A PREDICTIVE ANALYSIS OF SELECTED SPATIAL CHANGES CAUSED BY THE LOCATION OF A COLLEGE IN A SMALL TOWN

By

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PREFACE

The writing of a thesis can be a long and tedious process. During the course of such a task, there are many people whose contributions should be noted. In this case, I would like to thank Mr. James Stine and Dr. John Rooney for their professional guidance, and Dr. Robert Norris, whose enthusiasm, advice, and support of graduate students made possible this and many other theses.

I would like to acknowledge Alan Jackson, Dave Lewis, Mary Gebhart, and Bruna Parolin for their encouragement and friendship. Lastly, I would like to express my heartfelt thanks to my wife Debbie and daughter Melissa--who spent many lonely nights while I worked on this.

To the reader, I advise looking at this work for the method that it expresses and applying it in a real world situation.

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CHAPTER I

INTRODUCTION

This thesis is concerned with predicting geographic aspects of changes that could occur if a major university should be established within a specific area. The basic tenets and techniques used are taken from economic geography and applied to a problem that has its roots in the profession of regional planning. The thesis will be developed to study the predicted changes on three levels to obtain a broad perspective of what would occur as opposed to what a regional planning agency might do in this situation. Of course, in attempting to solve the problem in this manner some of the detail concerning actual money flow, physical changes, social changes, etc., will be lost. To achieve the level of detail described above much more information about the city, region, and the institution would be necessary but, for a hypothetical situation such as this, a large amount of information does not exist. The phraseology used in the text of this thesis should not lead the reader to believe that a university will be instituted in the study area as this is not the case; this problem is purely hypothetical.

The problem is to analyze and predict selected changes caused by locating a major state supported university in

Atlantic, Iowa, on a three-level scale consisting of the microregion, within the city; the mesoregion; within southwest Iowa; and the megaregion, Iowa and surrounding area. This area was selected due to work accomplished previously by the Workers Progress Administration in 1933-1934 and Brian J. L. Berry's (1962) interpretation of this data and his gathering and analyzing data for 1960; these accomplishments identify a central place hierarchy that has been analyzed over time and thus set a remarkably prepared study area for research of this nature.

Specific Problem and Techniques

The specific problem is to analyze selected changes that will occur in the study area if a state university of 5,000 students is located within the town of Atlantic. On the first level basic-nonbasic methods of analyzing local economics will be used to determine the nature of the economy of Atlantic before and after the university is established, and to estimate population changes within the town. Changes in population bring about corollary changes in the number and type of goods and services offered within the community which is the basis for analyzing changes on the second level. On this second level the methods and concepts of central place theory and retail trade gravitation will be used to predict changes that might occur within the central place hierarchy or the retail trade environment of the mesoregion.

The third level analysis will use concepts of retail

trade gravitation to determine from what area of the state the students who will attend this university will come. Determine, then, how many students from this area may attend the university.

The Study Area

The study area as related earlier will be dealt with on three levels. The first level, that of the microregion, consists of the town of Atlantic, Iowa. Atlantic lies within southwest Iowa (see Figure 1), and according to the 1970 census (U.S. Bureau of the Census, 1972) has a population of 7,306 and occupies an area of 2.6 square miles.

The second level study area (mesoregion) is similar to that presented in the study by Berry (1962) (see Figure 2) and consists of five counties and forty-six towns of various population.

The third level (megaregion) is represented over a space designated by the distances separating Atlantic from colleges and universities already in existence whose student draw zones might seriously be affected by a new university at Atlantic (see Figure 3).

The state universities in Iowa are Iowa State University, located at Ames; University of Iowa, located at Iowa City; and University of Northern Iowa, located at Cedar Falls (see Figure 3). It is apparent that the state supported universities are concentrated in the northeast part of the state. Atlantic was selected as the site for this study as

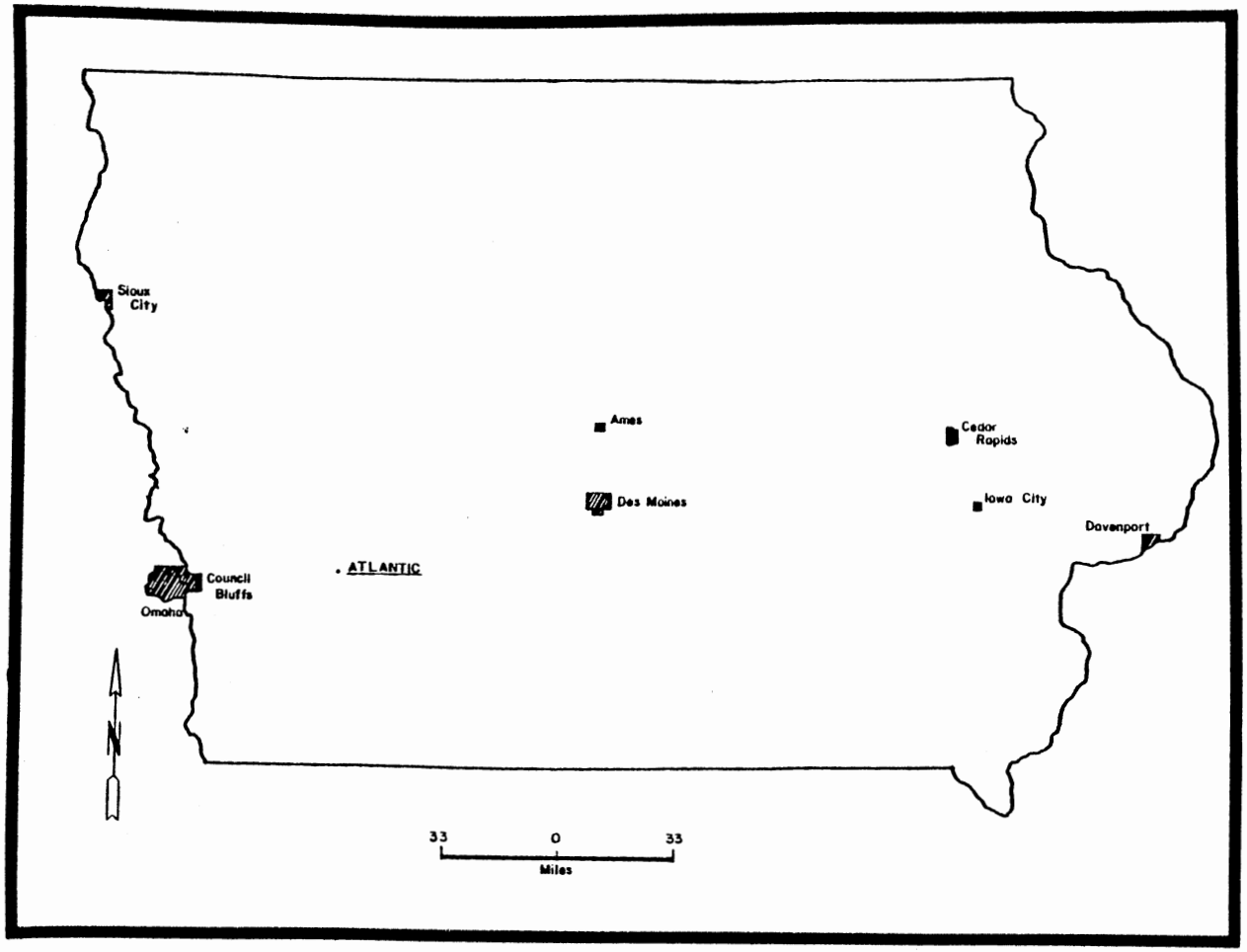

Figure 1. Location of First Level Study Area; Atlantic

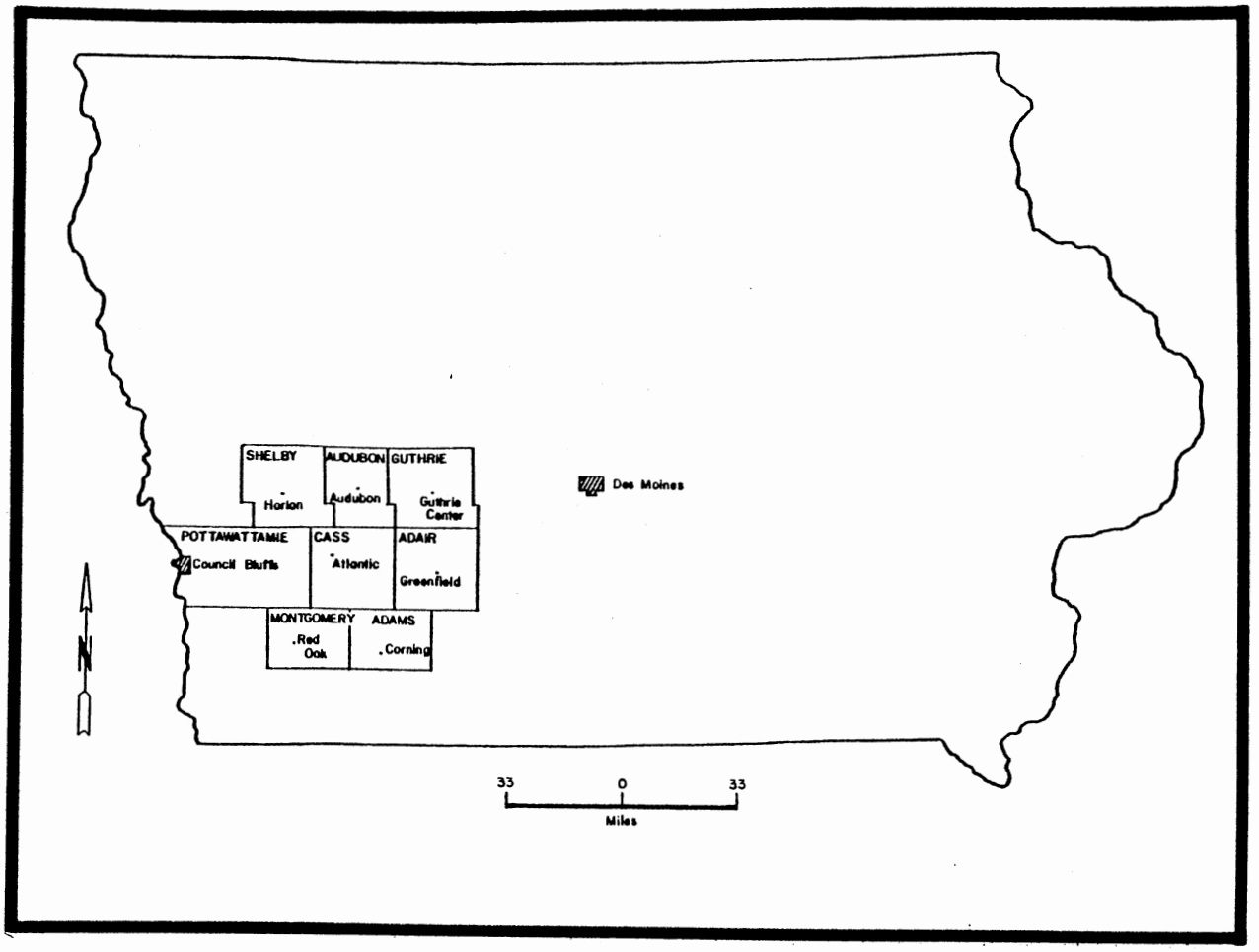

Figure 2. Location of Second Level Study Area

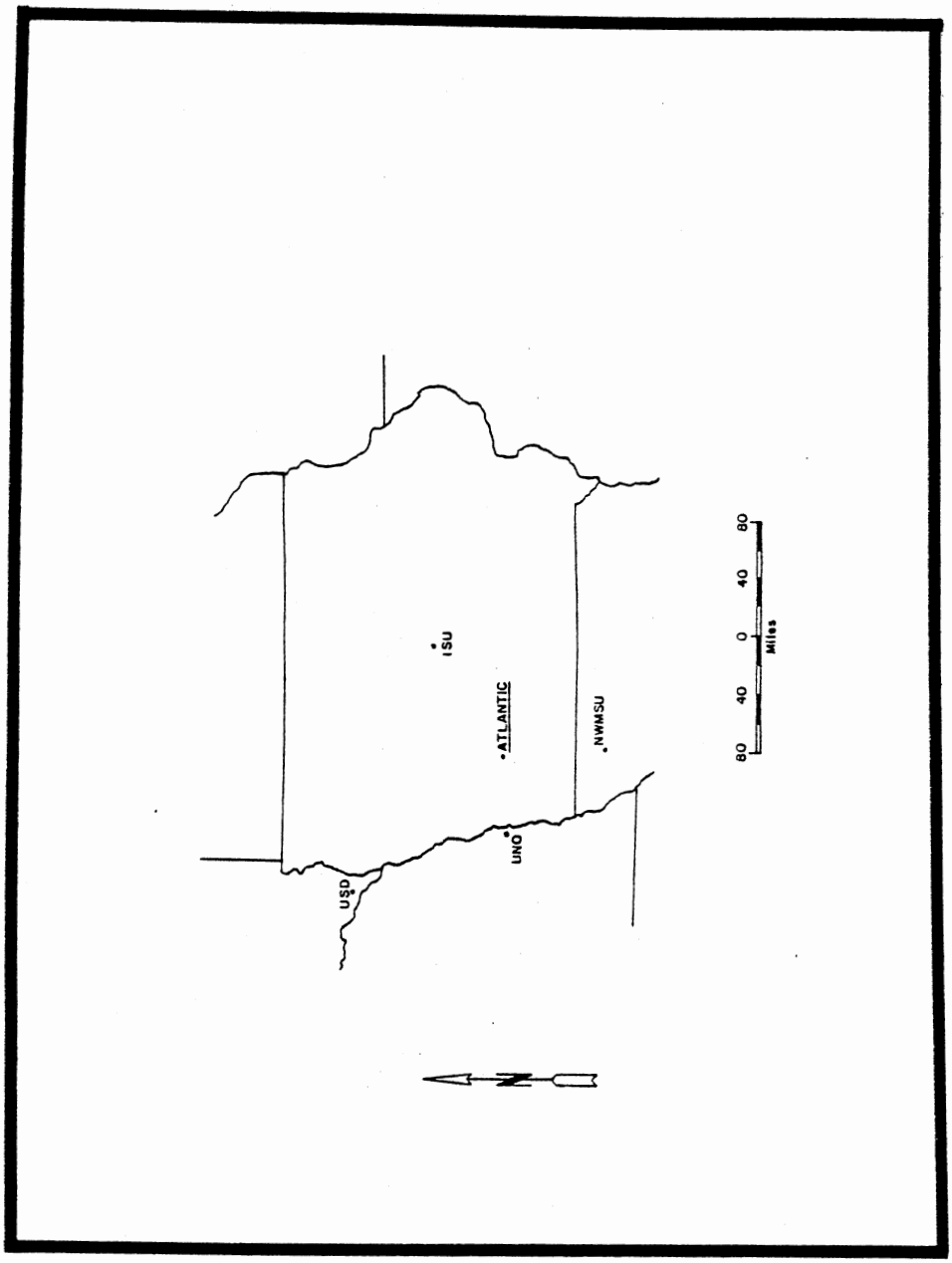

Figure 3. Third Level Study

it is located in the western college "void" and visually tends to balance out the University of Northern Iowa.

Review of the Pertinent Literature

Studies concerning the prediction of the impact of a university on the local economic environment per se are extremely scarce in the literature within the fields of geography, economics, or urban and regional planning. Related studies and methodologies concerning industry impact have recently dealt more with the physical environment than with the economy. The earlier, and the more recent specialized industrial impact analyses that have concerned themselves with economic aspects of the environment tend to emphasize input-output analysis, cash flow, and systems approach, thus neglecting the larger spatial view.

In order to achieve the larger spatial view, the intention is to look at two systems of phenomena distributed over space to determine if causal change will take place. The pioneer work in this area is Christhaller's (1933) (see Baskin, translator, 1966) Central Places in Southern Germany in which the theory of towns having trade areas in proportion to their size was first posited. From this position the idea of cities developing into a hierarchy providing goods and services according to the amount of demand[1] that maximized space by arranging themselves into patterns of

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[1]Demand in this case is equated with population.

hexagons was developed. Thus, Christaller arrived at the theories of high and low orders of goods and services, the spatial distribution hierarchy, and the notion of the centrality of the city.

One of the first articles to appear that applied modern statistical techniques to central place theory to establish a basis for the interclassification of city size and central function, Berry and Garrison (1958), placed central place theory within the range of the quantitative revolution. The technique used fifty-two variates, services that could be found as none, one, or many, and fifteen attributes, places either had this attribute or they did not, to set up a matrix on which factor analysis was performed with correlation regression methods. The results of the testing produced a trichotomy of city size, urban function similar to that of central place theory. The testing also showed a direct relationship between orders of goods and services and city size with higher order goods and services existing in places with greater population and lower order goods and services in places with a lesser population.

Schwartz (1963) contains an excellent description and analysis of the "laws of retail trade gravitation" by W. J. Reilly and Paul D. Converse. These models are based upon the gravity model discussed below and are designed to approximate the breaking point between cities beyond which one or the other dominates the retail trade environment.

John Q. Stewart was the driving force behind using

concepts and ideas from physics and applying them to groups of people, or social masses. Thus, "social physics" was born and soon came to be accepted and utilized by social scientists. Geographers in particular accepted the gravity-potential model as the model looked at human interaction over space. The central idea behind the model is that social masses tend to interact in direct proportion to their size (population) and inversely proportional to the distance between them. Stewart (1941) was the first to apply this model to the student draw zones of various size colleges. In looking at colleges around the nation, he found that the gravity-potential model was a good rough measure of student draw zones east of the Rocky Mountains. West of the Rocky Mountains, the model produced excellent results.

An extension of Stewart's idea (Kariel, 1968) is shown by a model in which student enrollment was associated with long distance phone calls between the college town and counties in the state as a measure of spatial interaction. This test produced a high correlation ($r = .98$) and was checked using the gravity model. Each method produced basically the same results.

While no literature was found concerning predicting the impact of a college on its community, there were a few articles concerned with analyzing the impact of an existing college on the surrounding area. The best of these (Laub, 1972) established a methodology for examining the socio-economic impact of the college. First the population input

of the college was determined, then the population was related to factors of social and economic growth and community development. Special emphasis was directed to these factors: family income, property values, commercial development, attitudes, and educational levels. Several colleges and towns of varied sizes were analyzed to note differences in faculty-staff residence, and the number of central functions that were present. The conclusions to this analysis were that in larger towns more of the faculty and staff tended to reside within it, and more central functions were present, within the town itself.

Another work (Kraushaar, 1964), dealt strictly with the economic contribution of a college to its surrounding area and defined a college as a basic industry. The study was concerned primarily with the amount of money that a college, in this case the University of Bridgeport, added to the economic base of the area, Bridgeport, Connecticut. The results were that if the University of Bridgeport were not there, an estimated $10,000,000 in total spending would be lost and an additional $8,542,000 in estimated generated income brought into Bridgeport would be lost.

In contrast to the scarce amount of literature on the prediction of the economic impact of a college, there is a large quantity of literature concerning the basic-nonbasic concept of urban economic functions. A succinct description of this concept is given by Alexander (1954), and by Yeates and Garner (1971). A "basic" industry has been defined as

an activity that brings a flow of money into the city or region from outside the city; whereas, a "nonbasic" industry is an activity that, eventually moves money out of the city. Further work in this area (Andrews, 1954) determined that students are economic base "associates" in that they spend money within the community having brought it from outside the community.

Another method of estimating the basic-nonbasic ratio was developed by Ullman and Dacey (1960). This method uses a sampling of a number of cities of the same general size, analyzing the census classifications of employment. Within each classification the smallest percentage reported, of all cities, is separated. The remaining group of "minimums" is then considered to be the minimum percentage of employment needed to enable the inner workings of the city to move, or the nonbasic component of the local economy. Ullman and Dacey reported this method to be quite effective and accurate for estimating the basic-nonbasic ratio.

However, it was also reported by these authors (Ullman, Dacey, and Brodskey, 1971) that the location quotient method and the minimum requirements approach to estimating the economic base should differ on the order of 10 percent. Upon completion of both types of analysis for Atlantic a difference far beyond that (59.85%) was discovered in the final determination. Due to this difference the most conservative estimate, that of the location quotient, will be actively

pursued throughout the remaining part of the thesis. The minimum requirements analysis will be reported in the appendix for reference.

CHAPTER II

FIRST LEVEL ANALYSIS

This chapter will study the proposed university as a job producing phenomenon. The number of jobs will, after making some allowances, allow us to predict the increase in population that can be directly attributable to the university.

In this chapter and in succeeding chapters we will assume that no unemployment exists in Atlantic. This is not unreasonable as Atlantic has had low unemployment figures historically, 2.4% in 1970 (U.S. Bureau of the Census, 1973).

The Basic-Nonbasic Ratio

All cities with a population of 2,500 or more, Atlantic included, have the characteristics of their work force reported in the United States Census. Using this data for Atlantic and for the nation as a whole, a series of location quotients will provide a means of deriving the economic base of the city. After adding the basic jobs created by the university's presence, the economic base ratio acquired from analyzing the census data will produce the number of nonbasic or service jobs created to meet the service demands of the new basic population.

The location quotient method of determining the economic base (Chapin, 1965) compares each Census division of labor, as a percentage of the total work force, for both Atlantic and the nation according to the formula:

$$Q_j = \frac{X_j}{X_i}$$

Where; Q_j is the location quotient for Atlantic;

X_i is the percentage of Atlantic's work force in the census division;

X_i is the percentage of the nation's work force in the division.

A value of 1.0 or more for the location quotient (Q_j) indicates that the division being tested is basic for Atlantic, as it is proportionally above the national norm. Table I provides the data for testing and table two presents the results of the analysis.

From the results presented in Table II, Atlantic has 1,856 basic units and 1,171 nonbasic units of employment. By dividing the nonbasic units by the basic units, a basic-nonbasic ratio of 1 to .63 is obtained.

The University

Any university has three main associations or contingents inherent to its structure: 1) the students, 2) the faculty, and 3) the administration and staff. For the university in Atlantic, a student body of five thousand

TABLE I

RELATIONSHIP OF ATLANTIC'S WORK FORCE TO THAT OF THE NATION

Division	Atlantic # of employed by division	(X_j) %* of total	United States No. of employed by division	(X_j) %* of total
Construction	251	8.3	4,634,065	6.1
Manufacturing Non Durable Goods	272	9.0	8,091,658	10.6
Manufacturing Durable Goods	80	2.6	11,772,551	15.5
Transportation	63	2.1	2,858,747	3.8
Communications, Utilities, and Sanitary Services	164	5.4	2,348,680	3.1
Wholesale and Retail Trade	997	32.9	14,738,944	19.3
Finance, Business, Insurance and Repair Services	177	5.8	6,280,177	8.2
Professional and Related Services	444	14.7	7,369,135	9.7
Professional Educational Services	183	6.0	6,171,132	8.1
Public Administration	118	3.9	4,215,525	5.5
Other	278	9.2	7,697,557	10.1
TOTAL		99.9	76,178,171	100

*Totals may not equal 100 due to rounding.

Source: U.S. Department of Commerce
Bureau of the Census

Subject Reports: Occupation by Industry

TABLE II

LOCATION QUOTIENTS FOR CENSUS DIVISIONS OF EMPLOYMENT

Classification	$Q_j = \frac{X_j}{X_i}$	Basic	Basic Economic Contribution	Nonbasic Economic Contribution
Construction	1.36	Yes	251	0
Manufacturing (All)	.85	No	0	272
Manufacturing (Durable Goods)	.17	No	0	80
Transportation	.55	No	0	63
Communications, Utilities, and Sanitary Services	1.74	Yes	164	0
Wholesale and Retail Trade	1.70	Yes	997	0
Finance, Business, Insurance, and Repair Services	.71	No	0	177
Professional and Related Service	1.51	Yes	444	0
Professional Educational Services	.74	No	0	183
Public Administration	.71	No	0	118
Other	.91	No	0	278
TOTAL			1,856	1,171

has been specified to provide a medium size university to balance the University of Northern Iowa, while keeping a realistic eye on leveling national collegiate enrollment trends. The number of faculty needed to teach these students has been determined using a student faculty ratio of seventeen students for each faculty member. This ratio was taken from Cartter (1976) as he reports it to be the average for the nation's colleges and universities. Cartter also noted that this ratio has remained nearly constant since 1968. Applying this ratio to the five thousand students it is apparent that 294 faculty will be needed. Another ratio, student to administration and staff, has been ascertained to be nineteen to one (Goodwin, 1978) and when applied to five thousand students, 263 administration and staff people will be needed to administer the university and to keep its records, accounts, grounds, physical plant, etc., in order.

Combining both of the results of these ratios, 557 jobs will be generated by the new university. According to Alexander (1954), these jobs can be considered basic as they bring money into the community.

According to Cook (1970), students are economic base associates, bringing money into the community from outside. Cook also answers the question, "Just how much do students contribute to the economic base?" To solve this problem it is necessary to estimate the amount of student expenditures and compare the result with the median income of Atlantic using the formula given below. The result is a multiplier

that when applied to the number of students will produce a figure representing the student body's contribution to the economic base as "full time basic employees."

$$M = \frac{E}{I}$$

Where; M is the student multiplier;

E is the estimation of annual student expenditures;

I is the median income for Atlantic.

Regression analysis was used to obtain an estimate of student expenditures for a college of this size, located in southwest Iowa. Cost estimates and college sizes were taken from Cass and Birnbaum (1972) for five state supported colleges near Atlantic, Northeast Missouri State University at Kirksville, Missouri; Northwest Missouri State University at Maryville, Missouri; University of Northern Iowa at Cedar Falls, Iowa; the University of Iowa at Iowa City, Iowa, and Iowa State University at Ames, Iowa. These data are listed in Table III.

The "r" value of .93 shows a strong positive relationship that is valid at a 95% level of accuracy, for predicting college expenses as a function of college size. The predicted value (y) for college expenses, specifying a college size of 5,000 is $1,469.35 per student per school year. The median income for Atlantic is $8,710.00 (Bureau of the Census, 1973); thus the formula devised by Cook results in

TABLE III

SIZE AND COSTS OF NEARBY COLLEGES

	Cost Estimates	Total Enrollment
N.E.M.S.U.	1,378	6,272
N.W.M.S.U.	1,500	4,770
U.N.I.	1,840	9,741
I.S.U.	2,020	19,620
U.OF I.	2,284	20,604
r = .93	a = 1236.72	
b = .064	y = 1469.35	

a multiplier of .180, which when multiplied by 5,000 (the student enrollment of the proposed school at Atlantic) results in a student contribution of 899 units of basic economic activity.

In totaling the units of basic activity added to the economy of Atlantic, 1) faculty, 2) administration and staff, and 3) the students (294 + 263 + 899), 1,456 units of basic activity are accrued. Yeates and Barner (1971) reported a method that can be used to estimate the total generated employment activity that is associated with an increase in basic activities. The method states that for every unit of basic activity added to the economy an increase in nonbasic activities will occur that is proportional to the basic-nonbasic ratio. When the nonbasic increase is added to the basic increase the result is total generated employment activity. In order to maintain a true perspective

on the number of jobs created, it is necessary to subtract the number of student base associate units, for while they create demand for jobs they are not "jobs" per se. This activity takes the form of the equation:

$$T = (B_i \cdot S) + (B_i - A)$$

Where; T is the number of jobs created;

B_i is the number of basic units added;

S is the denominator of the basic-nonbasic ratio;

A is the number of student base associates.

When the calculated values are substituted into the equation, and T is obtained, the result indicates that 1,474 jobs will be generated by the university in Atlantic.

Before the total number of permanent residents brought into Atlantic can be figured, an accounting must be made of the number of faculty, and administration and staff wives that will take jobs within the community. Nationally 28.6% of wives whose husbands earn $15,000 or more work outside the home (Bureau of the Census 1970). Here it is assumed that incomes of all university employees will average about $15,000; thus we can subtract 28.6% (159) of the total number of university employees from the total number of jobs generated leaving 1,315 jobs. This represents an approximation of the number of university employees' wives which will take a job in Atlantic. For the jobs created within

the community, or the service employment, nationally 39.6% of married women are active participants in the labor force (U.S. Bureau of the Census, 1973-). To arrive at a final figure for the number of jobs created that heads of household Will assume, we subtract 39.6% (521), representing the wives of the workers outside the university who assume part of the jobs remaining (after allowing for the university wives) leaving 794 jobs to be assumed by heads of households.

The 794 remaining jobs may be multiplied by the national average of household size of 3.1 persons (U.S. Bureau of the Census, 1972) to arrive at a projected estimate of the total settlement activity caused by the university. This results in the addition of 2,461 persons. Household size averages were available for other geographic divisions, specifically Iowa (3.2) and Cass County (2.8), the national average was chosen to accept the probability that the people brought into the community would represent a cross section of the national population. Although they are residents, students are not included in the population increase as the "attractiveness factor" of the students has already been accounted for. Thus, it would not be appropriate to enter them again into the calculations.

For the purposes of the next chapter, which will discuss possible changes in the hierarchy of cities and the trade area of Atlantic, it will be assumed that all of the settlement activity will take place within Atlantic.

CHAPTER III

SECOND LEVEL ANALYSIS

A common question in any college town that one may hear is, "What would this town be like if the college were not here?" Perhaps the analysis in this chapter will help bring at least a partial answer to that question. This chapter will determine what changes will occur in the economic environment of Atlantic (the mesoregion) due to the increase in population of 2,461 (see Chapter II) brought about by the university. This chapter will study two facets of the economic environment, the first being Atlantic as a central place relative to the other cities in the mesoregion. The second facet of the economic environment consists of the spatial limits which determine where people will shop for what type of good.

Predicted Changes in the Hierarchy of Central Places

The hierarchy of central places according to Berry (1962) consists of seven levels--hamlet, village, town, small city, regional city, regional metropolis, and national metropolis. The population size of these levels will vary relative to the number of nonpredictable job producing

enterprises, but for the state of Iowa, Berry stated the size sequence to be approximately 100, 500, 1,500, 6,000, 60,000, 250,000, and 1,000,000 plus. Berry went on to associate the type of goods and services that each size of center and its hinterland could support. Atlantic was classified as a small city, which has the attributes of having a population of around 6,000 persons, also being a county seat, and being a shopping goods center. For a more complete discussion of central place size and function see Berry and Garrison 1958.

In 1960 Atlantic had a population of 6,890, was the county seat, for Cass County, and was determined by Berry to be a shopping goods center. In 1970 Atlantic had a population of 7,306 and was still the Cass County seat, and presumably is still a shopping goods center. From the analysis in Chapter Two a population increase of 2,461 may be expected from the establishment of a university at Atlantic bringing the total population to 9,767. According to Berry's conditions an increase of about 50,000 persons would be necessary to place Atlantic in the next level of the hierarchy, that of regional city. So, despite the increase in population, Atlantic will remain in the small city category.

Retail Trade Gravitation

The development of trade area boundary models was initiated by Reilly and developed by Paul D. Converse. Reilly in his work The Law of Retail Gravitation (1st

edition New York: William J. Reilly Company, 1931), as quoted in Schwartz (1963), describes his first retail trade model:

> Two cities attract retail trade from any intermediate city or town in the vicinity of the breaking point approximately in direct proportion to the population of the two cities and in inverse proportion to the square of the distance of these two cities to the intermediate town.

$$\frac{B_A}{B_b} = \frac{P_A}{P_b}\frac{D_b}{D_a}$$

Where; B_A is the proportion of retail trade from the intermediate attracted by city A;

B_b is the proportion attracted by city B;

P_A is the population of city A;

P_b is the population of city B;

D_a is the distance from the intermediate town to city A;

D_b is the distance from the intermediate town to city B.

Reilly's model, as stated, attempts to find the proportion of retail trade two cities attract from an intermediate town.

Converse (1949) has deducted mathematically from Reilly's model another equation that will find the breaking point between two cities. The breaking point has been defined as the point which separates the trade area dominance of two settlements. Trade at the point is divided exactly between the two cities. The equation takes the form of:

$$B = \frac{DAB}{1 + \frac{P_A}{P_b}}$$

Where; B is the distance of the breaking point from b;

$D_A + D_b$ is the distance along the most direct improved highway from city A to city B;

P_A is the population of city A;

P_b is the population of city B.

If a hierarchy of central places, such as the one in southwest Iowa, is being studied that offers different levels of goods and services, depending on the level of the hierarchy on which the cities lay; and if people are willing to travel only short distances to get inexpensive items that are needed regularly and to travel farther to acquire goods and services on a higher level of the hierarchy; then it must be assumed that breaking points exist for each order of goods and services that a city provides to its hinterland.

The retail trade area of Atlantic in 1970 has been measured according to the model developed by Converse for three levels of the hierarchy set by Berry (1962) for this area. The first level, that of the village (or full convenience center), which offers goods and services on a very low order such as a gas station, grocery store, church, and tavern. The second level, that of the town (or shopping goods center), offers a higher order of goods and services

such as auto repair, auto parts dealers, drug stores, furniture stores, feed stores as well as the functions of the village. The third level, that of the small city (or specialty goods center), is the last level that has been studied and offers goods and services of the first two levels as well as some of a higher order such as clothing stores, jewelry stores, lumber yards, daily newspaper, auto sales, farm implement dealers, and others. Atlantic's trade area has been measured again allowing for the increases in population that was determined in Chapter I to be a result of the establishment of the university.

Atlantic's Trade Area and Predicted Changes

The data necessary to compute the breaking points between all other settlements and Atlantic are, according to Converse's model, the population of the other settlement, the population of Atlantic, and the shortest distance on improved roads between them. Table IV contains this data for the village level of goods and services, Table V for the town level and Table III for the small city level. The purpose of reporting the change in trade area for village level of goods and services is to complete the hierarchy, the Reilly-Converse method was developed for goods at a higher order. These tables also contain the "B" values, or the distance of the breaking points from the smaller center. Tables VII, VIII and IX contain the same data allowing for the population increase caused by the university. In

addition the tables have the results of the analysis (B) as well as figures showing the distance of the breaking point from Atlantic. Tables IV, V, and VI also contain figures showing the net change in B for each (ΔB).

After analyzing the data in Tables IV and VII and displaying the results in Figure 4, the change in the average distance from Atlantic to the breaking point for village level goods and services is 0.30 miles away from Atlantic and the average change for the distance factors (B) also 0.30 miles. For the town level of goods and services, Tables V and VIII and Figure 5 the change in the average distance from Atlantic to the breaking point is 0.46 miles away from Atlantic and the average change is 0.50 miles. For the small city order of goods and services the change in the average distance is 1.21 miles away from Atlantic and the average change for the distance between Atlantic and the other cities is 1.25 miles; see Tables VI and IX, and Figure 6.

In this analysis it appears that Atlantic's trade area for village level functions has increased approximately three tenths of a mile in all directions. For town level functions the trade area has increased approximately one-half mile in all directions, and for small city level functions has increased about one and one-quarter miles in all directions.

It has been demonstrated that the addition of 2,461 persons has increased the trade area for three levels of

goods and services. An increase in trade area can be readily translated into new customers for the merchants of Atlantic, especially in the case of small city functions. An increase in the amount of spending in Atlantic will serve, through taxes, to provide income for public services benefiting the whole community. Although Atlantic would not move up in the urban hierarchy, the additional population would create and induce a significant impact upon the economy of the mesoregion.

TABLE IV

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS FOR THE VILLAGE LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	Distance of B from Atlantic in miles
Anita	13	7,306	1,101	3.64	9.36
Cumberland	15	7,306	385	2.80	12.20
Elkcorn	14	7,306	667	3.25	10.75
Exira	18	7,306	966	4.80	13.20
Lewis	8	7,306	526	1.69	6.31
Marne	6	7,306	187	.83	5.17

TABLE V

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS FOR THE TOWN LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	Distance of B from Atlantic in miles
Anita	13	7,306	1,101	3.64	9.63
Exira	18	7,306	966	4.80	13.20
Griswold	17	7,306	1,181	4.88	12.12
Massena	25	7,306	433	4.89	20.11
Oakland	24	7,306	1,603	7.66	16.34
Walnut	13	7,306	870	3.34	9.66

TABLE VI

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS FOR THE SMALL CITY LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	Distance of B from Atlantic in Miles
Audobon	27	7,306	2,907	10.44	16.56
Corning	31	7,306	2,095	10.81	20.19
Council Bluffs	51	60,348	7,306	13.16	13.16
Greenfield	44	7,306	2,212	15.62	28.38
Guthrie Center	40	7,306	1,834	13.35	26.65
Harlan	33	7,306	5,049	14.89	18.11
Red Oak	35	7,306	6,210	16.79	18.21

TABLE VII

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS, ALLOWING FOR PREDICTED POPULATION INCREASE, FOR THE VILLAGE LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	ΔB	Distance of B from Atlantic in Miles
Anita	13	9,767	1,101	3.27	.37	9.73
Cumberland	15	9,767	385	2.48	.32	12.52
Elkcorn	14	9,767	667	2.90	.35	11.10
Exira	18	9,767	966	4.31	.49	13.69
Lewis	8	9,767	526	1.50	.19	6.50
Marne	6	9,767	187	.73	.10	5.27

ΔB = 0.30 miles.

TABLE VIII

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS ALLOWING FOR THE PREDICTED POPULATION INCREASE FOR TOWN LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	ΔB	Distance of B From Atlantic in Miles
Anita	13	9,767	1,101	3.27	.37	9.73
Exira	18	9,767	966	4.31	.49	13.69
Griswold	17	9,767	1,181	4.38	.50	12.62
Massena	25	9,767	433	4.35	.54	20.65
Oakland	24	9,767	1,603	6.91	.75	17.09
Walnut	13	9,767	870	2.99	.35	10.01

ΔB = 0.50 miles.

TABLE IX

RETAIL TRADE BREAKING POINT DATA AND ANALYSIS ALLOWING FOR PREDICTED POPULATION INCREASE FOR SMALL CITY LEVEL OF GOODS AND SERVICES IN 1970

Atlantic and	$D_A + D_b$	P_A	P_b	B	ΔB	Distance of B From Atlantic in Miles
Audobon	27	9,767	2,907	9.53	.91	17.47
Corning	31	9,767	2,095	9.81	1.00	21.19
Council Bluffs	51	60,348	9,767	14.63	1.47	14.63
Greenfield	44	9,767	2,212	14.18	1.44	29.82
Guthrie Center	40	9,767	1,834	12.09	1.46	27.91
Harlan	33	9,767	5,049	13.80	1.18	19.20
Red Oak	35	9,767	6,210	15.52	1.27	19.48

ΔB = 1.25 miles.

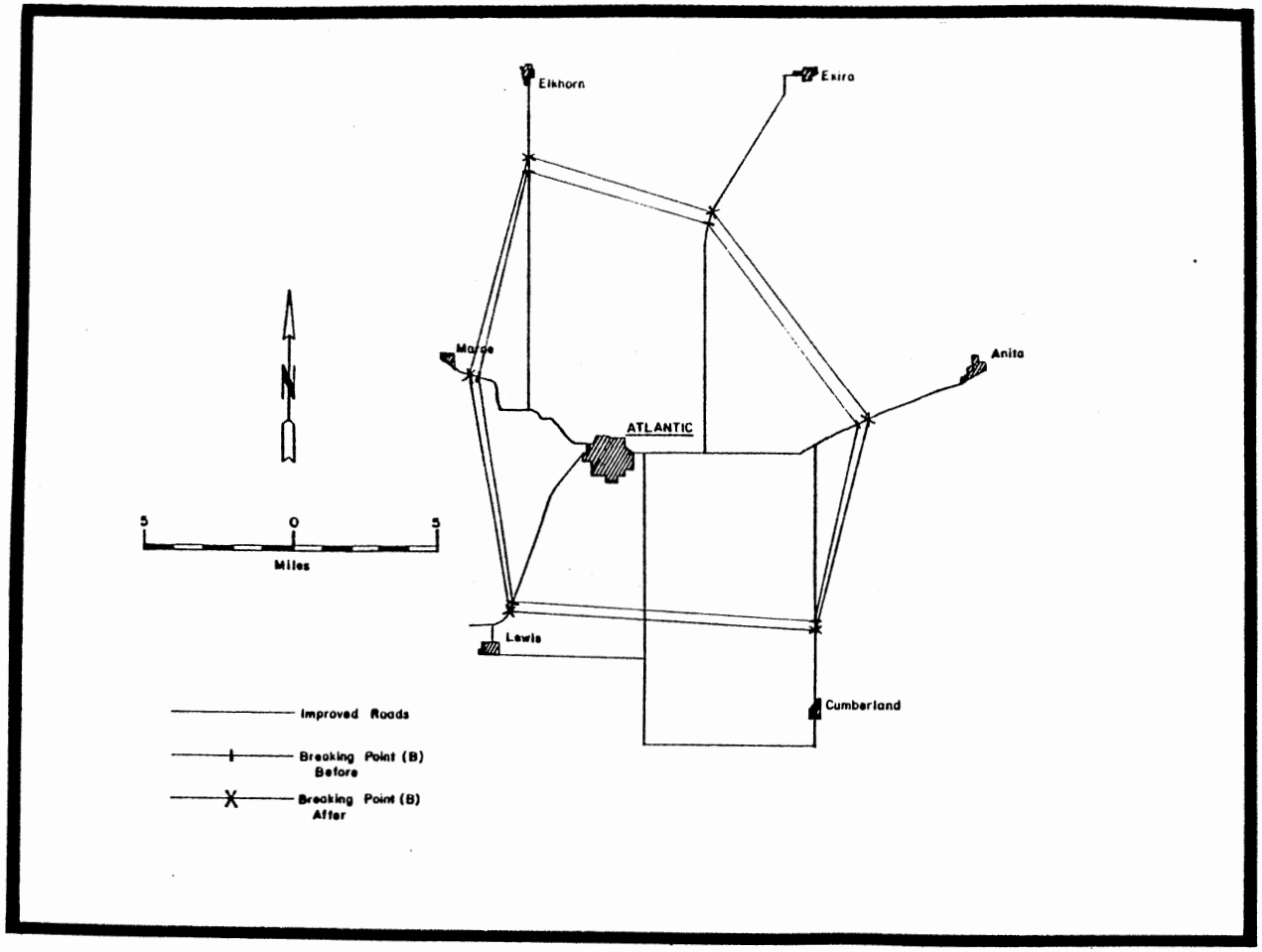

Figure 4. Atlantic's Trade Area, Village Level Functions

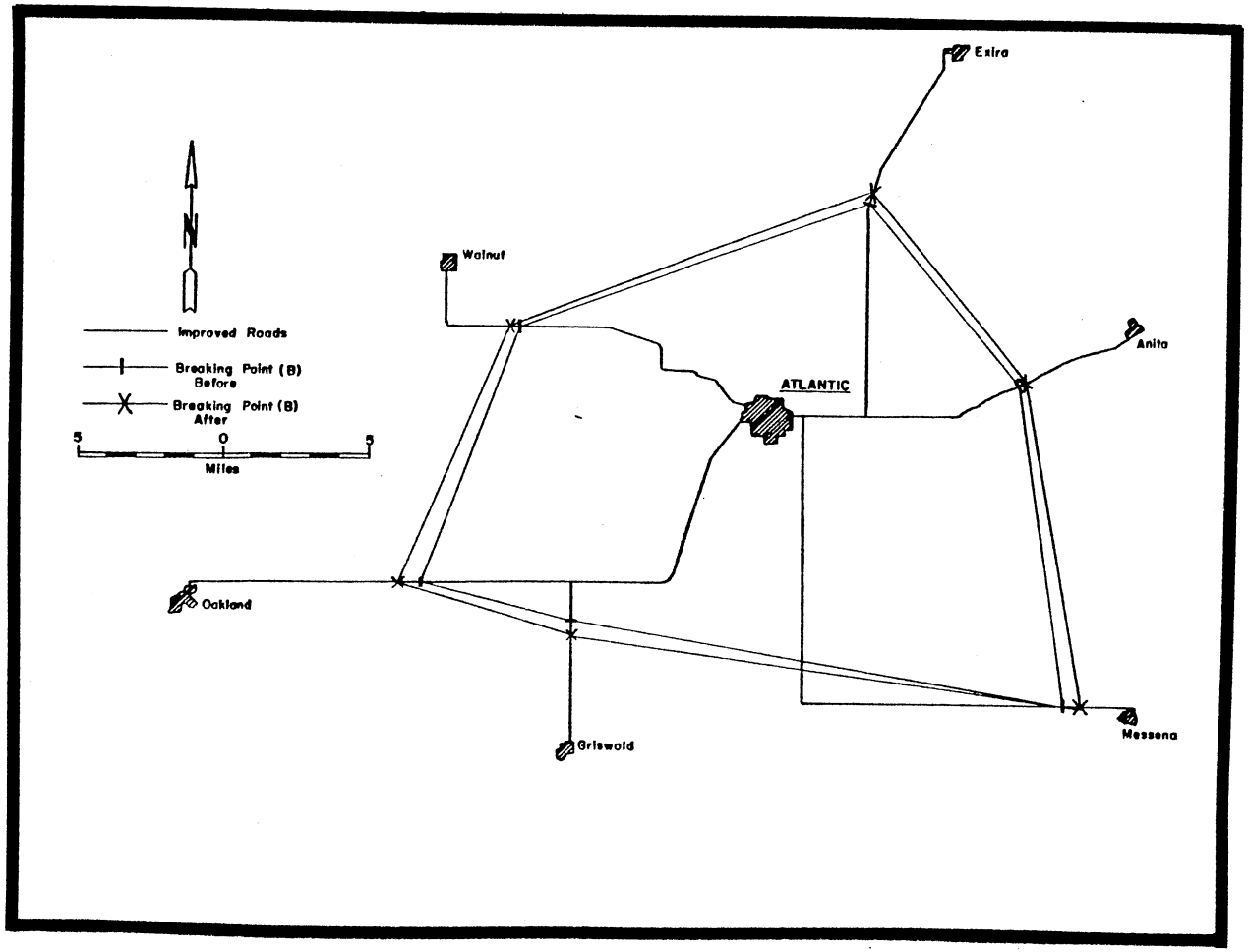

Figure 5. Atlantic's Trade Area, Town Level Functions

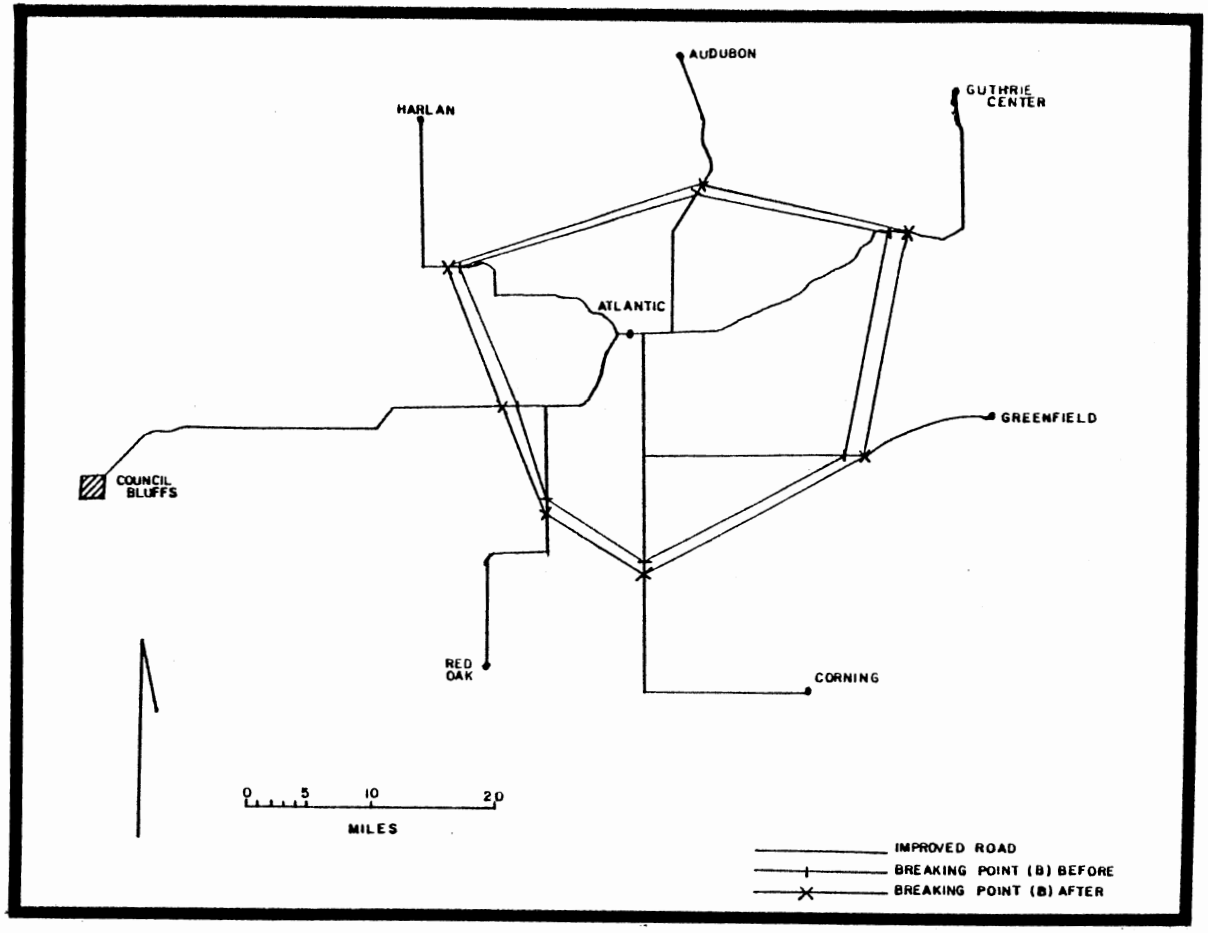

Figure 6. Atlantic's Trade Area, Small City Level Functions

CHAPTER IV

THIRD LEVEL ANALYSIS

The third level analysis will concern itself with the feasibility of locating a college at Atlantic. One of the primary concerns of locating an institution of higher learning anywhere is having enough students attending to assure the success of the venture. There are other important factors contributing to the feasibility of establishing any college such as funding, political support, and public opinion that will not be dealt with in this work.

The first phase of this analysis determines what area of the state will be the home area of the college, insofar as students will primarily attend this school in defense to others. For this purpose a college education will be looked upon as a service or a good to be purchased by the college age population (ages nineteen through twenty-four). Several studies, McConnell (1965), Kariel (1968), and Stewart (1941), have used the spatial interaction model to study student enrollments determining that they display a distance decay. The major hinderance of this type of analysis being the spatial interaction model's inability to deal with intervening opportunities as they present themselves in the landscape of higher education. McConnell has attempted to

alter the form of the model in an attempt to take intervening opportunities into account but arrived at no refinement that was, according to him, better than the original.

In an attempt to overcome the problem of intervening opportunities the extension of the basic spatial interaction model developed by Reilly (1931) and Converse (1949) was utilized. The model, presented and described in the previous chapter, takes the form:

$$B = \frac{D_a + D_b}{1 + \frac{P_a}{P_b}}$$

Where; B is the distance of the breaking point from city B;

$D_a + D_b$ is the distance along the most direct improved highway from city A to city B;

P_a is the population of city A;

P_b is the population of city B.

It is felt that since higher education can be considered a service the public may purchase, that the acquiring of a college education might well follow the principles that apply to the public's willingness to travel to obtain goods and services. As described in Chapter III, the model presented above can be used to delimit the area over which a city or a town has dominance for the retail supply for a level of goods and services. With this in mind, the model was adapted to delimit the area of dominance over which the

college at Atlantic would supply higher education.

The adaptation of the model was formed by replacing cities with the universities around Atlantic and the college to be instituted there, substituting straight desire line distance for highway distance, and using size of college in lieu of city population. Desire line instances have been found to be more appropriate when dealing with "one decision" types of goods and services, such as expensive furs, large pieces of machinery, etc. Here it is assumed that a college education is one such expensive, "one decision" type of service. The adapted model takes the form:

$$B = \frac{D_a + D_b}{1 + \frac{E_a}{E_b}}$$

Where; B is the distance of the breaking point from college B;

$D_a + D_b$ is the desire line distance from college A to college B;

E_a is the enrollment of college A;

E_b is the enrollment of college B.

The model was applied to the colleges surrounding Atlantic, the results of this analysis are displayed in Table X. The results for the University of Nebraska at Omaha seemed to be over estimated for two reasons, first U.N.O. does not have dormitory facilities and second out-of-state tuition in Nebraska is very high (Cass and Birnbaum, 1972). These two factors make it seem unlikely that very

TABLE X

RESULTS OF THE ADAPTED MODEL

Atlantic and	$D_a + D_b$	E_a	E_b	B
Northwest Missouri State University	76	5,500	5,000	36.19
University of Nebraska at Omaha	52	13,900	5,000	13.756
Iowa State University	93	19,274	5,000	19.156
University of South Dakota	155	6,386	5,000	68.066

much of the population of southwest Iowa would be compelled to attend U.N.O. if they had an adequate alternative at lower cost. Thus, for this analysis the breaking point (B) between Atlantic and U.N.O. will be assumed to be the Iowa-Nebraska border. The other two universities that are located outside of Iowa have dormitories and do not have exorbitant out-of-state tuition, thus the breaking points for these two have not been altered.

The results of this analysis are presented on map No. 7. The shading represents the area in which most of the people, who decide to go to college, would attend the college at Atlantic.

The second phase of the third level analysis determines the amount of students within the zone delineated on map No. 1 that may be expected to attend the college at Atlantic. To

do this the counties that have the greater part of their area lying within the zone pictured on map No. 1 will have determined for them the number of college aged persons living within the county and the number of those college aged persons who might be expected to attend a college. The method used to determine this was to extract from the U.S. Census of 1970 the number of males and females of college age (19-24) that were within the area described above (see Table XI) determining the percentage of each, males and females, that may attend college, presumably at Atlantic.

TABLE XI

COLLEGE AGE PERSONS IN THE AFFECTED AREA BY COUNTY AND SEX

	Males	Females
Adair	244	209
Adams	147	171
Audobon	239	230
Cass	426	546
Cranford	671	690
Harrison	472	513
Ida	215	221
Mills	460	505
Montgomery	340	398
Monona	282	324
Pottawattomie	3,063	3,847
Shelby	403	428
Union	413	522
TOTAL	7,375	8,604

The percentage of persons attending college in Iowa was determined by summing the number of males and females nineteen through twenty-four who were enrolled in college (U.S. Census, 1970) then dividing those sums by the total number of college age males and females in Iowa (see Tables XII and XIII).

An estimate of the number of students within the area defined on Figure 7 was obtained by multiplying the percentage of college age males by the number of college aged males and adding this product to the number of college aged females in the area multiplied by the percentage of college age females attending college in the State of Iowa.

$$(7{,}375 \times .2040) + (8{,}604 \times .1171) = 2512$$

The estimate of 2,512 students coming from the area defined on Figure 7 is pessimistic for at least three reasons. Persons eighteen years of age and younger, as well as persons older than twenty-four were not included in the percentage analysis, inclusion of these age groups would have increased the estimate. A college close at hand might induce a greater number of persons to attend college, and students now attending an out-of-state institution might now stay in Iowa either to avoid out-of-state tuition or travel.

In summary, we found the "service" or "home" area of the college at Atlantic to consist in whole or in major part of thirteen counties in southwest Iowa having 7,375 college age males and 8,604 college aged females. Working from the

TABLE XII

FEMALES ENROLLED IN COLLEGE IN IOWA, BY AGE

Age	Number	Total Females Ages 19-24	Percent Attending
19	5,144	N.A.	N.A.
20	4,144	N.A.	N.A.
21	3,171	N.A.	N.A.
22	1,877	N.A.	N.A.
23	952	N.A.	N.A.
24	392	N.A.	N.A.
TOTAL	15,680	133,906	.1171

Source: U.S. Bureau of the Census, Special Reports: School Enrollment, PC(2)-SA, 1970.

TABLE XIII

MALES ENROLLED IN COLLEGE IN IOWA, BY AGE

Age	Number	Total Males Ages 19-24	Percent Attending
19	6,650	N.A.	N.A.
20	5,739	N.A.	N.A.
21	4,689	N.A.	N.A.
22	3,312	N.A.	N.A.
23	2,438	N.A.	N.A.
24	1,538	N.A.	N.A.
TOTAL	24,366	119,423	.2040

Source: U.S. Bureau of the Census, Special Reports: School Enrollment, PC(2)-5A, 1970.

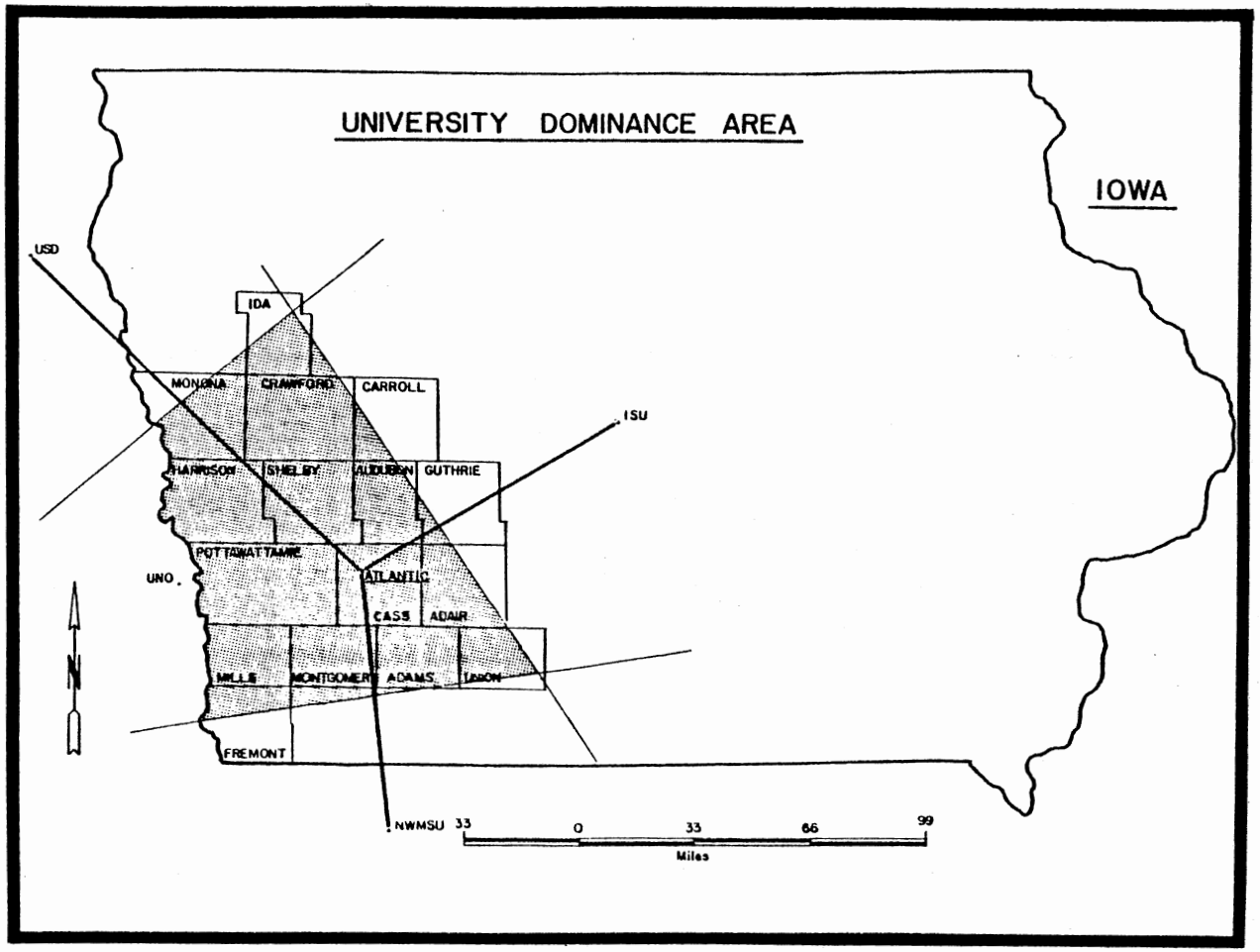

Figure 7. University "Trade" Area

percentage of males and females in Iowa who attend college a predicted 2,512 students would attend college at Atlantic if given the opportunity. The last statement is subject to these qualifications. This will happen if student enrollment is subject to the same principles defined by Reilly and Converse; if percentages of students attending other colleges is a valid method of predicting enrollment at another college, and if the assumptions regarding out-of-state tuition and dormitory facilities at the University of Nebraska at Omaha are true and valid, it is the author's opinion that at least 2,512 potential students from the immediately surrounding area is enough to justify the opening of the school. The remaining one-half of the student body will have to come from across Iowa, adjoining states, the nation, and foreign countries..

CHAPTER V

ALTERNATIVE FUTURES

Introduction

This chapter will attempt to extrapolate alternative futures for Atlantic beyond the time of changes described previously. The time setting for these "futures" is in approximately fifty or sixty years from the establishment of the university; this span of time is necessary to see what further changes might have been caused by the university's presence and its effects upon the community.

No Growth

The Atlantic fifty or sixty years from now under the assumption of no or very little growth looks quite a bit as it did five years after the college was completely built. The university added a new dimension to the town; however, after the initial period of growth the momentum faltered and died.

The story behind this is the towns/people, after initially supporting the new school, grew to resent the students, faculty, and administrators for their snobbery, money, and new homes. Thus, the community was divided into

three parts: 1) pro-university, 2) anti-university, and 3) the business that served them both. This situation of hostility provided a poor climate for the attraction of new entrepreneurs to Atlantic.

Much Growth

This Atlantic is quite a bit different than it was at the time the college was built. Two new industrial parks have been opened and a third is being planned. There are several new businesses downtown and in the outskirts. The new businesses in the outskirts to serve the newer housing development. In this case the university was the stone that caused an economic bonanza.

The underlying factor causing this was community mobilization. When Atlantic was selected as the site of the new university, the citizens were very proud and excited. As the university was being constructed, the civic leaders, city council, and mayor had a comprehensive plan completed that predicted the impact that the college would have, where growth would have, where growth would occur, and what to do about it. Thus, as the growth took place in an orderly manner, the citizens of Atlantic supported the school for the beneficial results it had on business.

As part of an on-going planning process, an industrial park was planned and developed for the town. The Chamber-of-Commerce actively sought out new industry until a new park was necessary. There was no need to seek out industries for

the new park, as several had been waiting for its completion. Of course the new industries attracted new people, and the people attracted new business, and the new businesses expanded the trade area even more. The well-planned growth attracted even more new industries setting off another round of growth. Atlantic became an awakening giant.

Moderate Growth

This future of Atlantic lies somewhere between the "no growth" and the "much growth" future. The town looks much as it did after the college was built; however, the downtown is full and there is a new cassette tape assembly and recording plant and a new corn canning plant. This future was provided by the student body.

Some years after the university was built a man with a flair for opportunism discovered in Atlantic a large untapped labor pool--the student body. As it happened, this man had some land near the Nishnabotna River and he was determined to utilize it to his advantage. After a conference with an industrial development specialist and obtaining promises of the provision of utilities from the town, he contacted Columbia Recording Company and Green Giant Foods, Inc. The two were interested and the man completed the deal.

These additional basic industries brought in some additional people and businesses, but as the main labor pool consisted of students, these additions were slight.

Conclusion

Of the three alternative futures presented here, one is not any more likely to occur than another. This is so because, barring a depression, the people of a town or city must make the decision to act and make progress, or not act and avoid advancement.

CHAPTER VI

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Conclusions

This thesis has attempted, in a limited way, to answer part of the question, "What would happen if a college of 5,000 students were to be located at Atlantic, Iowa?" A great deal of the events that probably would occur in or near Atlantic if this happened have not been addressed here. This work has been divided into three parts studying selected changes in the microregion, mesoregion, and the macroregion. What follows is a synopsis of the findings presented in Chapters II, III and IV.

Chapter II was designed to look at caused change in the City of Atlantic. Perhaps the most immediate, drastic, and noticeable change is an increase in the population. Through the method presented in this chapter, an increase of 2,461 persons was estimated to be the result of the university being established.

The increase in population presented in Chapter II was related to the theories of central place (specifically the urban hierarchy) and to retail trade gravitation in Chapter III. According to the population size sequence of the

hierarchy of central places an addition of 2,461 persons would increase Atlantic's standing of "small city." The retail trade area of Atlantic was determined to have increased for the three levels of economic activity inherent in Atlantic's size: 1) village; 2) town; and 3) small city. The trade area of a town is traditionally measured using the population of the community, as the size of a community's population defines the amount and level of specialization of goods and services the community can support. Coincidentally the amount and level of goods and services determine the distance people are willing to travel to obtain them, thus determining the trade area of the community.

Atlantic's trade area for village level functions, those having the least level of specialization with people having no desire to travel great distances to obtain them, increased the least of the three, an average of three-tenths of a mile. Atlantic's trade area for town level functions, increased an average of nearly one-half mile in all directions. People being willing to travel farther to obtain these more specialized goods and services this trade area increased at a higher rate.

The trade area for small city level goods and services, being that of the most specialized goods and services, increased the most of any an average of nearly one and one-quarter miles in all directions.

The increase in trade are for Atlantic combined with the increase in population caused by the university will have

a significant impact on the mesoregion adding potential customers for the merchants of Atlantic, and attract new businesses to the community. The additional spending and the stimulation of business will also add to the tax base at Atlantic. These additional tax dollars will help provide public services for the additional population.

The fourth chapter diverges in direction some from the previous analysis chapters. In this chapter the "trade zones," or the areas from which students attend college, of existing colleges and the college at Atlantic were analyzed to determine the feasibility of establishing a college at Atlantic. The actual question being one of "Is there enough students to support a college?" By assuming a university to be the equivalent of a town in that a university offers a service to a population distributed over space a derivative of the spatial interaction formula was used to determine these home areas. The formula used was the same as the one used to determine retail trade areas in the previous chapter. The result was that an estimated 2,512 students from a defined area would choose a college at Atlantic over other colleges.

Thus, it seems that with a base of 2,512 students a college at Atlantic would indeed have a good chance at survival, picking up additional students from around the state and elsewhere.

Suggestions for Future Research

There is a need to develop methods for predicting the impact of major new enterprises on the local economy. It was mentioned earlier that most of the work in this area, at the present, is centered around the computer and require any number of specialists to manipulate and interpret the data. As this specialized help can often be quite expensive, it would be extremely unfortunate to hire them when it may be unnecessary to do so. The type of analysis presented in this thesis (Chapters II and III) can, with modifications, be used as a preliminary analysis tool to determine if a more complex analysis is needed.

There are several refinements which need to be made in this type of analysis and in the techniques used to derive some of the components. The first and foremost of these needed refinements is a more accurate determiner of the basic-nonbasic ratio. This ratio is the factor upon which the rest of the analysis is based. As such an inaccurate ratio will seriously prejudice the results, other refinements due serious consideration for research are alternative methods of finding multipliers for determining spouse employment, dependent employment (teenagers), and household size. Perhaps some simple statistical methods could be used to aid in the determination of these multipliers.

Methods for determining the "trade area" of a college and university are at the present time clumsy and inadequate. The main thrust of this type of research is centered around

the spatial interaction model. This seems to be correct direction for this research to follow. One major problem that needs to be dealt with, along this line of research, is that of the intervening opportunity. For this obstruction, the spatial interaction model must have built into it a factor that would allow for the attraction of the competing colleges. This research can become quite complex considering 1) varying distance, 2) size of college, and 3) type of college. The complexity of the distance, size, and type problems might be handled with a specially devised computer program based upon a multi-dimensional matrix. A matrix of this type may be able to handle these three problems as well as provide the essential data for a modified spatial interaction model.

A SELECTED BIBLIOGRAPHY

Alexander, John W.

1954 "The Basic-Nonbasic Concept of Urban Geographic Functions." Economic Geography, 30 (July), 246-261.

Alexander, John Wesley.

1963 Economic Geography, Englewood Cliffs, New Jersey: Prentice-Hall.

Andrews, Richard B.

1954 A "Mechanics of the Urban Economic Base: Special Problems of Base Identification." Land Economics (August), 260-269.

Andrews, Richard B.

1954 B "Mechanics of the Urban Economic Base: The Problem of Base Measurement." Land Economics (February), 52-60.

Bendarid, Avrom.

1972 Regional Economic Analyses for Practitioners, New York: Praeger.

Berry, Brian, J. L.

1967 Geography of Market Centers and Retail Distribution. Englewood Cliffs, New Jersey: Prentice-Hall.

Berry, Brian, J. L. and Garrison, William L.

1958 "The Function Base of the Central Place Hierarchy." Economic Geography, 34 (April), 145-154.

Berry, Brian, J. L. and Smith, Katherine B.

1972 City Classification Handbook; Methods and Applications. New York: Wiley-Interscience.

Bonner, Ernest R.

1968 "The Economic Impact of a University on Its Local Community." Journal of the American Institute of Planners, 34 (September), 339-343.

Braschler, Curtis and Kuehn, John A.

1976 "Estimation of Employment Multipliers for Planning in Ozarks Nonmetropolitan Counties." Journal of Southern Economics (July), 187-192.

Brown, Douglas M.

1974 Introduction to Urban Economics. New York: Academic Press, Inc.

Cartter, Allan M.

1976 Ph.D's and the Academic Labor Market. San Francisco: McGraw Hill Book Company.

Cass, James and Birnham, Max.

1972 Comparative Guide to American Colleges, 5th Edition. New York: Harper and Row.

Chapin, F. Stuart, Jr.

1965 Urban Land Use Planning. Urbana: University of Illinois Press.

Christaller, Walter.

1966 Central Places in Southern Germany, translated by Carlisle W. Baskin. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Cook, Edgar D., Jr.

1970 "Analyzing University Student Contribution to the Economic Base of the Community." Annals of Regional Science, 4 (June), 146-153.

Emerson, M. Jarvin and Lamphear, F. Charles.

1975 Urban and Regional Economics. Boston: Allyn and Bacon, Inc.

Goodwin, William.

1978 Assistant Director of University Personnel Services. Oklahoma State University, Interview, October 16.

Hansen, Niles M.

1975 The Challenge of Urban Growth: The Basic Economics of City Size and Structure. Lexington, Mass.: Lexington Books.

Isard, Walter.

1971 Regional Input-Output Study. Cambridge: MIT Press.

Kariel, Herbert G.

1968 "Student Enrollment and Spatial Interaction." Annals of Regional Science, 2 (December), 114-127.

Kraushaar, John L.

1964 "How Much of an Asset is a College." College and University Business, 36 (February), 43-45.

Laub, Julian Martin.

1972 The College and Community Development: A Socio-economic Analysis for Urban and Regional Growth. New York: Praeger.

Leahy, William Harral; McKee, David L.; and Dean, Robert D.

1970 Urban Economics, Theory, Development, and Planning. New York: Free Press.

Losch, August.

1954 The Economics of Location, translated from the second revision edited by William H. Woglom with the assistance of Wolfgang F. Stapler. New Haven: Yale University Press.

McConnell, Harold.

1965 "Spatial Variability of College Enrollment as a Function of Migration Potential." The Professional Geographer, 17 (November), 29-37.

Reilly, William J.

1931 The Law of Retail Gravitation. New York: William J. Reilly Company.

Richardson, Harry Ward.

1969 Regional Economics. New York: Praeger.

Schwartz, George.

1963 Development of Marketing Theory. Cincinnatti: Southwestern Publishing Company.

Smith, David M.

1975 Patterns in Human Geography: An Introduction to Numerical Methods. New York: Crane, Russak and Co.

Stewart, John Q.

1941 "The Gravitation or Geographical Drawing Power of a College." Bulletin of the American Association of University Professors (February), 18.

Thoman, Richard; Conkling, Edgar; and Yeates, Maurice.

1968 The Geography of Economic Activity. New York: McGraw-Hill Book Company.

United States Department of Commerce: Bureau of the Census.

1970 Subject Reports: Employment Status and Work Experience. PC (2)- SA. Washington, D.C.: U.S. Government Printing Office.

United States Department of Commerce: Bureau of the Census.

1972 Subject Reports: Occupation by Industry, PC (2) - 7C. Washington, D.C.: U.S. Government Printing Office.

United States Department of Commerce: Bureau of the Census.

1973 City and County Data Books, 1972. Washington, D.C.: U.S. Government Printing Office.

Yeates, Maurice II, and Garner, Barry J.

1971 The North American City. New York: Harper and Row.

APPENDIX

Using twenty Iowa cities of a population between 6,000 and 9,000 the minimum requirements have been determined for each census division of labor. These results appear in Table XIV.

TABLE XIV

MINIMUM REQUIREMENTS FOR IOWA CITIES

Census Division	Minimum %
Construction	2.3
Manufacturing	
Non Durable	2.3
Durable	1.6
Transportation	1.1
Communications, Utilities, and Sanitary Services	1.2
Wholesale, Retail Trade	19.3
Finance, Business, Insurance, and Repair Services	3.8
Professional and Related Services	8.1
Professional Educational Services	6.6
Public Administration	1.5
Other	6.1

Table XV compares the minimum requirements of each Census Division with that of Atlantic in the manner described by Ullman and Dacey (1960).

TABLE XV

MINIMUM REQUIREMENT COMPONENTS FOR ATLANTIC

Census Division	1 Atlantic %	2 Minimum Requirement %	1-2 Basic Employment
Construction	8.3	2.3	6.0
Manufacturing			
Non Durable	9.0	2.3	6.7
Durable	2.6	1.6	1.0
Transportation	2.1	1.1	1.0
Communications, Utilities, and Sanitary Services	5.4	1.2	4.2
Wholesale, Retail Trade	32.9	19.3	13.6
Finance, Business, Insurance, and Repair Services	5.8	3.8	2.0
Professional and Related Services	14.7	8.1	6.6
Professional Education Services	6.0	6.6	-0.6
Public Administration	3.9	1.5	2.4
Other	9.2	6.1	3.1
TOTAL	100	53.9	46.0

The total in column three of Table IV represents that percentage of Atlantic's employment that is above the minimum required of a town the size of Atlantic and as such is basic.

This percentage expressed in terms of the basic-non basic ratio is 1: 1.7. Following the method used in the thesis and diagrammed in the flow chart in Appendix B the resulting increase in population is predicted to be 3,934.

This figure may be considered to be the highest probable increase, or if the validity of the location quotient method is in question this figure can be assumed to be a valid estimate and would vary high or low from that point. The more conservative estimate was used for determining trade area shifts, and throughout this thesis.

VITA

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Master of Science

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