THE IMPACT OF INDUSTRIALIZATION ON THE PRIVATE SECTOR AND PUBLIC SECTOR ECONOMIES OF WICHITA FALLS, TEXAS

DISSERTATION

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BY

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The purpose of this study was to examine the relationship between industrialization and changes that occurred in the local economy and the quality of life in a selected North Central Texas community which had experienced industrial growth. The objectives of the study were:

1. Measure the relationship between industrial growth and changes that occurred in the private sector economy

2. Analyze the impact of new industry on the cost of community services, specifically municipal government and the public school system, over the period of time during which the community experienced industrialization

3. Determine the changes in variables used to measure the quality of life, and examine the relationship of these changes with industrialization.

The data required to test the hypotheses to achieve the objectives of this study were obtained primarily from secondary sources. In those cases where data did not exist in published reports, it was obtained through examination

of public records and by personal interview with local business and municipal leaders. The model made extensive use of multiple regression and correlation techniques in examining the relationship between the growth in the number of persons employed by manufacturing companies and changes in the local economy and the quality of life.

Chapter I of the study presents and introduction to the study which includes (1) a statement of the problem, (2) objectives, (3) organization, (4) a definition of terms, and (5) the hypotheses. Chapter II presents a description of the methodology and includes a general description of the selected community. In Chapter III a review of similar studies is presented. Chapter IV presents an analysis of the relationship between industrialization and selected areas of both the private sector economy and the public sector economy as well as variables used to measure the quality of life in the community. The summary and conclusions are presented in Chapter V.

The evidence supports the contention that industrialization is accompanied by both costs and benefits. The private sector was stimulated by industrialization, resulting in increased business activity. Along with this economic stimulation came an increase in expenditures by both the municipal government and the public school system. The quality of life in the community was found to have experienced both gains and losses during the period studied.

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CHAPTER I

INTRODUCTION

The plant location decision is one of the most important decisions addressed by industrial management. The impact of such a decision is important not only to the company itself, but also to potential employees, to the local and state governmental agencies of the affected community, and to those individuals who live in the area.

In recent years companies have been looking to previously less industrialized areas for new plant locations. "Since the 1920's there has been a rapid increase in the industrial development in the southern and western regions of the country."[1] Evidence of this shift in industrialization can be seen from the data presented in table 1. Texas has participated in this growth. There are many reasons for the rapid industrialization that has occurred in the South, and in Texas in particular. Among the many reasons often cited for this phenomenon are mild climate, uncrowded surroundings, labor cost, labor productivity, tax advantages,

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[1]Gene F. Summers et. al., Industrial Invasion of Nonmetropolitan America (New York: Praeger Publishers, 1976), p. 8.

TABLE 1

MANUFACTURING EMPLOYMENT GROWTH
BY REGION, 1947-1963

Region	Number of States	Percentage Growth
United States	48	45.2
Northeast	9	-0.2
North Central	12	21.1
South	16	50.7
West	11	100.9

Source: Leonard F. Wheat, Regional Growth and Industrial Location (Lexington, Massachusetts: D. C. Heath and Co., 1973), p. 3.

and land costs. Much of the region is a repository of traditional American values--patriotism, self-reliance,and respect for authority;and both racial disorders and street crime are relatively rare.[2] The political atmosphere is generally conservative, and residents of Texas, as well as the other southern states have been wary of organized labor. All but three Sunbelt states (California, New Mexico, and Oklahoma) have reinforced the normal resistance to unions with right-to-work laws.[3] These factors,

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[2]"Why Industry Is Moving South." Fortune, June 1977, p. 134.

[3]Ibid.

as well as others such as the absence of a state income tax, (both personal and corporate) have been used by Fantus (a leading industrial location consultant) to rank Texas as the state which provides the best business climate in the country.[4]

The introduction of industrial plants is often viewed by community leaders as a panacea for the area's problems. Metropolitan areas, as well as rural farming towns have formed committees to seek new industry. Much has been written to persuade local residents of the benefits of industrialization, and industrial parks have materialized with the aim of attracting business. Yet such campaigns often promote only the positive aspects of new manufacturing plants. Industrialization has many implications. It can provide new jobs and higher incomes; however, it may also increase the demand for improved and expanded community services.[5]

At the local, state, and national levels, policy-makers are still uncertain as to the total impact of industrial development on communities. In view of this fact, there appears to be a need for research which will focus the attention of decision makers on both costs and benefits of industrialization. Such research coupled with a review

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[4]Ibid., p. 136.

[5]Norman Kahne, "What This Town Needs . . .," Nation's Business February 1950 , p. 42.

of the experiences of other communities will help both municipal and industrial leaders to direct development programs toward desired objectives.

Statement of the Problem

Accompanying the shift of industry to the southern and western regions of the country has been a shift in the population. Evidence of this shift can be seen in table 2. The potential impact of such changes is tremendous. It is likely that the following variables will change as the phenomenon of industrial relocation occurs.

1. Income levels
2. Levels of employment and unemployment
3. Quality of living
4. Quality of public services
5. Secondary business activity
6. Population
7. Economic profits of affected areas

It is widely assumed that those communities which are successful in attracting new industry experience positive changes in these and other variables. On the other hand, when industry leaves an area, it is generally believed that the community is experiencing a potentially critical loss. Possible changes in the local economy suggest the need for a better understanding of the phenomenon of industrialization and its impact. It is hoped that this study will provide the needed

TABLE 2

POPULATION BY REGION
1940-1975
(millions)

Region	Number of States	1940	1950	1960	1970	1975	% Change 1940-1975
United States.	50	132,165	151,326	179,323	203,212	213,122	+ 61
Northeast.....	9	35,977	39,478	44,678	49,041	49,461	+ 37
North Central.	12	40,143	44,461	51,619	56,572	57,669	+ 44
South.....	16	41,666	47,197	54,973	62,795	68,114	+ 63
West.....	13	14,379	20,190	28,053	34,804	37,878	+ 163

Source: U. S. Bureau of the Census, Current Population Reports, series p-25, Nos. 460, 520, 533, and 615, (Washington, D. C.: U. S. Government Printing Office, 1940, 1950, 1960, 1970, 1975).

decision criteria to enable community residents and industrial leaders to make better decisions.

Objectives of the Study

This study investigates the impact of industrialization on a selected Standard Metropolitan Statistical Area--Wichita Falls, Texas--which is located in North Central Texas. Impact was measured by changes in economic variables in the public and private sectors, as well as by non-economic variables used to measure quality of life.

The objectives of this study were to:

1. Measure the relationship of new industry with the private and public local economy of Wichita Falls, Texas. The local impact consists of both primary and secondary effects. Primary or direct impacts are usually measured in terms of employment and payroll generated by new plants. Secondary impacts are often referred to as multiplier effects[6]

2. Analyze the impact of new industry on the costs of community services, specifically municipal government and public schools, over the period of time during which the community experienced industrialization

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[6]An example of a secondary effect would be the creation of additional jobs in other sectors of the economy, such as retail trade and service industries, as a result of expenditures by manufacturing firms and their employees.

3. Determine the changes in variables used to determine quality of life

4. Determine whether or not the relationships between industrialization and other changes in the local economy are significant

Organization of the Study

Chapter II presents a description of the methodology used in this study. Included in the section is a general description of the selected community.

In Chapter III a review of similar studies is presented. Differences and similarities between this study and previous ones are noted.

Chapter IV presents an analysis of the relationship between industrialization and selected areas of both the private sector economy and the public sector economy, as well as of the variables used to measure the quality of life in the community.

The summary and conclusions are presented in Chapter V.

Definition of Terms

Industrialization. Industrialization is the process whereby the number of manufacturing jobs and the percentage of total employment engaged in manufacturing is increased.

Manufacturing. Manufacturing is the business activity that is involved in the transformation of raw materials

into finished products, both durable and non-durable goods.

Private Sector. The private sector is defined as those non-governmental organizations which are involved in a profit-making activity. Specifically, for this study the following sectors were examined: retail, construction, real estate, manufacturing, and banking and finance.

Public Sector. The public sector consists of the municipal government and the public school system, which are financed through taxation and are involved in providing services to residents of the city.

Quality of life. Quality of life is an imprecise concept. Yet there seems to be little doubt that the climate, the low unemployment rates, and the relaxed life have been instrumental in attracting new business to Wichita Falls. In attempting to measure changes in quality of life, few guidelines are available. However, some widely used variables, some from the private sector, some from the public, and some from a combination of both are available. Among those used to measure changes in the quality of life were per-capita income, unemployment rates, mean value of homes sold, infant mortality rates, crime rates, traffic deaths, police and fire protection (measured by the ratio of population to policemen and firemen), and per-student expenditures by the public school system.

Hypotheses

In attempting to examine the relationships between the number of persons employed in manufacturing and the public and private sector economy of Wichita Falls, Texas, two hypotheses were tested. Data were collected to test the following hypotheses:

H_1 There is no relationship between changes in the private sector economy and increased industrialization in Wichita Falls, Texas.

H_2 There is no relationship between changes in the public sector economy and increased industrialization in Wichita Falls, Texas.

In addition, a third hypothesis was tested in order to achieve a sub-objective of this study, i.e., the examination of the relationship between industrialization and quality of life. The following hypothesis was tested:

H_3 There is no relationship between the quality of life and increased industrialization in Wichita Falls, Texas.

CHAPTER II

METHODOLOGY

Choice of Location

Wichita Falls, Texas, was chosen for this study for three primary reasons. First, the city is located in a part of the state which has proven to be attractive to industry. It is the population center of a twenty-six-county area in Southern Oklahoma and North Texas (see Figure 1). Second, and more significant, Wichita Falls has experienced a steady increase in industrialization over the past seven years. Some of the more significant variables which illustrate this growth are shown in table 3.

A third reason for selecting Wichita Falls for this study is the belief that the facts regarding costs and benefits of industrialization were not available in a meaningful form. After reviewing the presentations by the local news media, attending meetings where speeches were made by representatives of the Board of Commerce and Industry, and discussing the issue with concerned citizens from all walks of life, the writer felt that a more scientific answer to the questions raised by industrialization was needed. An objective of this study was to provide an analysis of all aspects of industrialization

Figure 1. North Central Texas and Southern Oklahoma

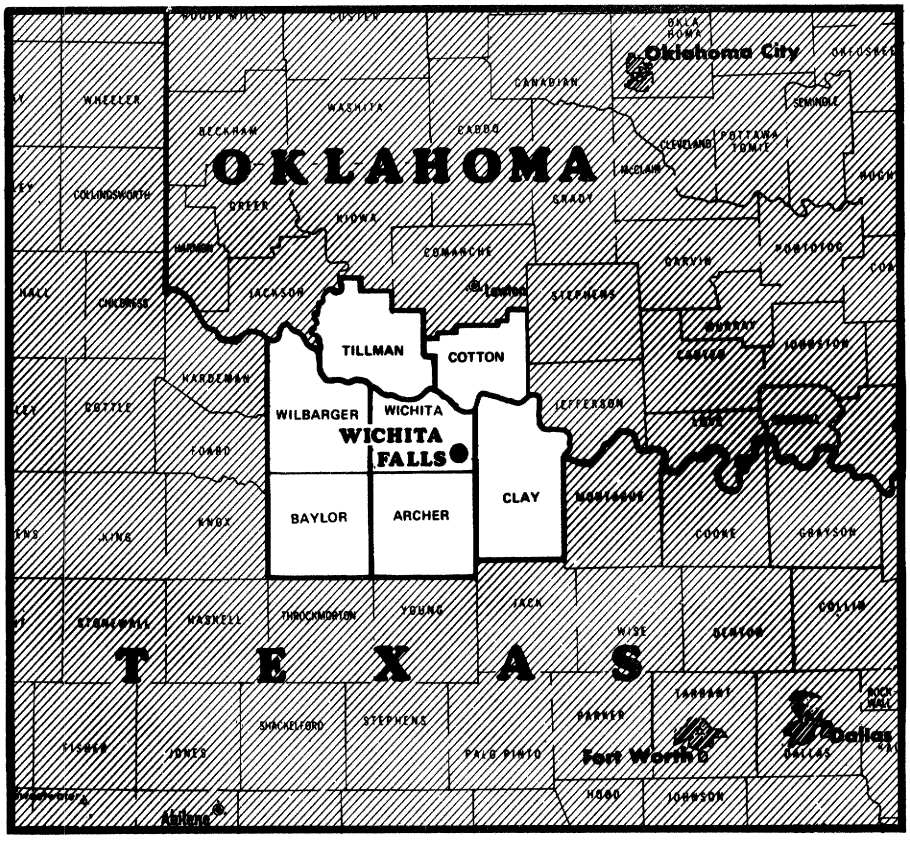

TABLE 3

VITAL STATISTICS FOR WICHITA FALLS, TEXAS 1970-1977

Year	Number of Persons Employed in Manufacturing	Percentage of Total Wage and Salary Employment in Manufacturing	Number of New Plants Located in City	Number of Plant Expansions in the City
1970	4,560	12.49	1	1
1971	4,990	13.26	3	4
1972	5,340	13.81	4	0
1973	6,110	15.02	3	3
1974	6,910	15.82	1	1
1975	7,140	16.30	1	2
1976	7,440	16.40	2	0
1977	8,090	17.04	3	5

Sources: Texas Industrial Commission, General Community Profile on Wichita Falls (Austin, 1977), pp. 230-34; and Texas Employment Commission, Manpower Trends (Wichita Falls, Texas, 1962-1977), passim.

in order to provide a more complete picture of what has occurred during a period of industrial growth.

Manufacturing employment has grown from an annual average of 4,560 in 1970 to 8,090 in 1977. These figures show that Wichita Falls' industrial development efforts have created over 3,500 new jobs since 1970. The number of manufacturing jobs as a percentage of total non-agricultural wage and salary employment has also grown from 12.5 percent in 1970 to 17.0 percent in 1977.[1] In addition, the rate of growth in the manufacturing sector has been rapid. From 1962 to 1969 the number of persons employed in manufacturing increased by 23 percent (3,135 to 3,857). From 1970 to 1977 the number of persons employed in manufacturing has increased by 77 percent. While strict comparisons are not appropriate, since statistical methodology differs and data is not available for 1977, a consideration of manufacturing employment in the United States and Texas further illustrate the industrial growth in Wichita Falls. Manufacturing employment as a percentage of the total employment has declined from 27 percent to 24 percent in the United States from 1970 to 1976, compared to an increase from 12.5 percent in 1970 to 17.6 percent in 1977 in Wichita Falls.[2] While

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[1]Texas Employment Commission, Manpower Trends (Wichita Falls, Texas, 1962-1977), passim.

[2]United States Department of Labor, Handbook of Labor Statistics (Washington, 1977), pp. 88, 98; and Wichita Falls Board of Commerce and Industry, Statistics, (Wichita Falls, Texas, 1977), p. 12.

manufacturing employment in Wichita Falls has grown by more than 77 percent since 1970, the number of people employed in manufacturing from 1970 to 1976 increased by 16 percent in Texas and declined by 2 percent in the United States.[3] All of these figures represent shifts from other types of employment to manufacturing, and at rates which exceed those in Texas and the United States as a whole.

Another means of determining the amount of industrialization is the number of new plants and existing expansions over a period of time. Since 1970, eighteen new plants have located in Wichita Falls, and sixteen existing plants have expanded their facilities.[4] Those plants employing the greatest number of employees are listed in table 4. In addition to the companies listed, the A. C. Division of General Motors has announced plans to build a plant in the city. The facility may eventually employ as many as nine hundred.[5]

Quantitative Techniques

The measurement of the effects of industrialization was undertaken by statistical comparison. The model

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[3]Ibid.

[4]Texas Industrial Commission, General Community Profile on Wichita Falls (Austin, 1977), pp. 230-34.

[5]Wichita Falls Board of Commerce and Industry, Statistics, p. 12.

TABLE 4

LARGEST MANUFACTURING COMPANIES
IN WICHITA FALLS, TEXAS
(January, 1977)

Name of Company	Number of Employees
PPG Industries	1100
Wilson Manufacturing	700
Certainteed	603
Levi Strauss & Company	485
Sprague Electric	430
Siemens-Allis Corporation	380
Cryovac	300
Surgikos	190

Sources: Wichita Falls Board of Commerce and Industry, "1977 Business Statistics." Wichita Falls, Texas 1977. (mimeographed).; and interviews with personnel managers of the companies, Wichita Falls, Texas, February 17, 1978.

made extensive use of multiple correlation and regression techniques. "Multiple regression is a general statistical technique through which one can analyze the relationship between a dependent or criterion variable and a set of independent or predictor variables."[6] The model examined the relationship between the growth in the number of manufacturing jobs and the private and public economies of Wichita Falls.

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[6]Norman H. Nie et. al., SPSS Statistical Package for the Social Sciences (St. Louis, 1975), p. 320.

After a review of the literature it was found that almost all who have studied the phenomenon of industrialization agree that the creation of jobs and increasing of incomes lies at the heart of local campaigns to attract industry. Once this process has begun, the multiplier effect starts and has an impact on other sectors of the economy. Figure 2 represents how this path of economic stimulation might theoretically work.

As the number of manufacturing jobs increases, so do incomes both in manufacturing and non-manufacturing jobs. The increase in the number of manufacturing jobs also increases the number of jobs in other sectors of the economy.

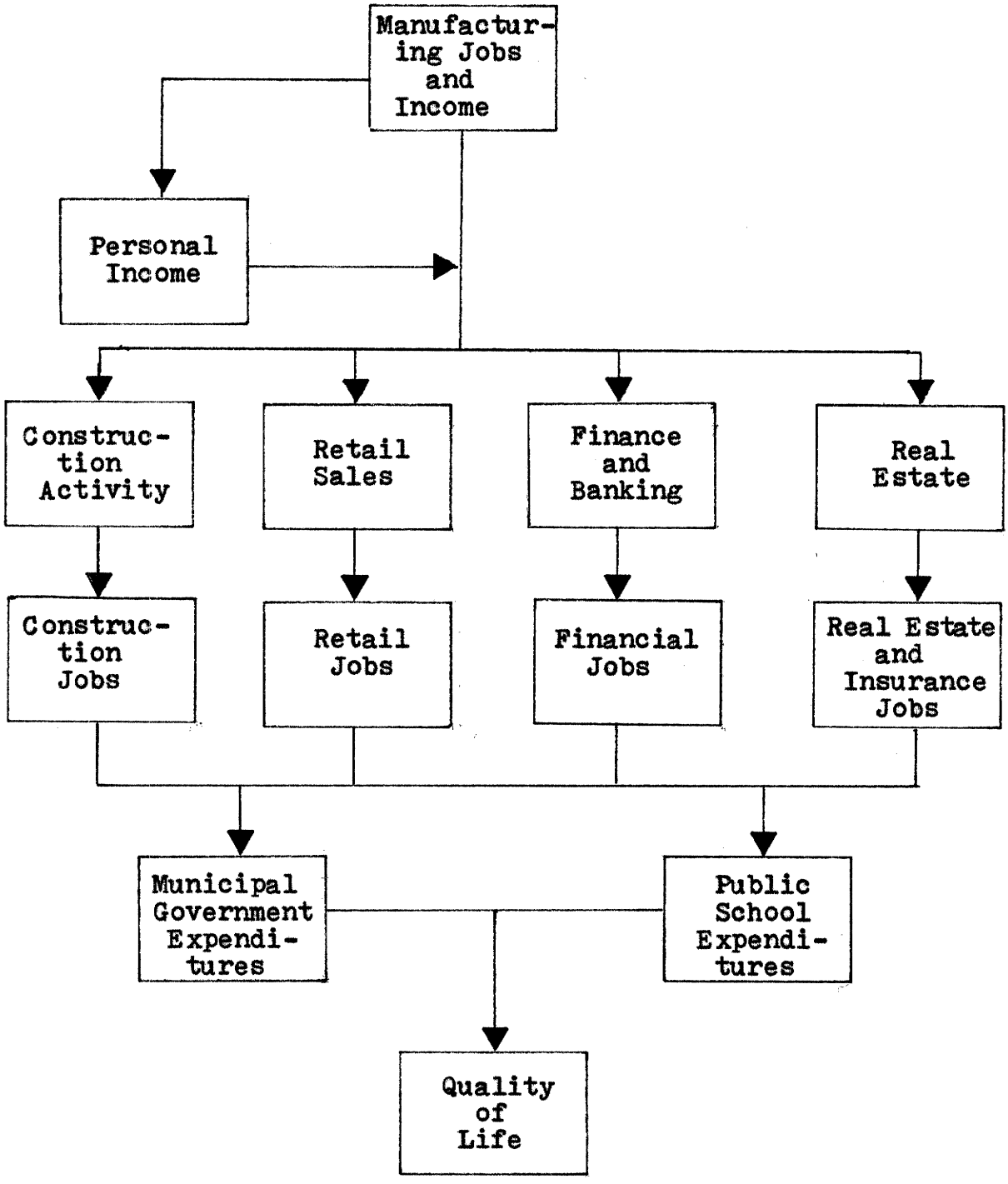
Private Sector And Industrialization

The private sector is stimulated in many areas. The four examined in this study were (1) construction, (2) retail, (3) finance and banking, and (4) real estate.

Private Sector Variables

The variables selected to examine the relationship between industrialization and the private sector were (1) housing starts, (2) employment in construction, (3) retail sales, (4) employment in retail business, (5) dollar value in city banks, (6) employment in finance, banking, real estate and insurance, (7) number of real estate transactions, and (8) mean value of houses sold.

Figure 2. Theoretical Flow Diagram of Impact of Industrialization on a Local Economy



Public Sector And Industrialization

The two areas of the public sector examined were (1) municipal government, and (2) public school system.

Public Sector Variables

The variables selected to examine the relationship between industrialization and the public sector were (1) municipal cost and revenue figures, and (2) school district cost and revenue figures.

To meet the sub-objective of this study--the examination of the relationship between industrialization and quality of life--those variables discussed on page 8 were examined.

The use of multiple regression and correlation allowed for an examination of the independent variable (industrialization) and different dependent variables such as personal income and non-manufacturing jobs. Multiple correlation allowed for the measuring of the importance of each individual variable taken separately, while simultaneously allowing for the variation associated with remaining independent variables. Multiple regression and correlation also allowed for the fact that many of the changes which have occurred can be attributed to factors other than industrialization. In this study it was assumed that a path analysis type of phenomenon occurs. Thus while retail sales might be the dependent variable when personal income

is the independent variables when school expenditures is the dependent variable.

Sources of Data

The data required to test the hypotheses to achieve the objectives of this study were obtained primarily from secondary sources. Levels of employment, income, municipal costs and revenue figures, retail sales, real estate values, and other data were determined through examination of Texas Employment Commission publications, Texas Industrial Commission, Bureau of the Census, and other publications, as indicated by footnotes. In those cases where data did not exist in published reports, it was obtained through examination of public records and by per-sonal interview with local business and municipal leaders. Instances existed where it was not possible to disaggregate city, county, and standard metropolitan statistical data. Such instances are noted by footnotes.

Delimitations of the Study

This study was conducted to examine the impact of industrialization on both the private and public sectors of Wichita Falls, Texas. The relationships between industrialization and several variables was examined to test the two primary hypotheses:

H_1 There is no relationship between changes in the private sector economy and increased industrialization in Wichita Falls, Texas.

H_2 There is no relationship between changes in the public sector economy and increased industrialization in Wichita Falls, Texas.

The data were also used to test the following hypothesis.

H_3 There is no relationship between the quality of life and increased industrialization in Wichita Falls, Texas.

The conclusions are limited to the city of Wichita Falls, and to some degree Wichita County. To expand the results of this study as being conclusive for any community experiencing industrialization would be incorrect. Each city is a separate and unique entity. However, the conclusions reached in this study might serve as a model for other areas considering industrialization, with regard to potential benefits and costs.

CHAPTER III

REVIEW OF THE LITERATURE

Various issues have been addressed in attempting to measure the impact of new manufacturing plants on a community. Among the issues explored are changes in the following: population distribution and size, commuting patterns, employment levels, multiplier effects, unemployment levels, income, other business activity, and local governmental revenue and expenditures. The purpose of this chapter is to present a review of previous studies which have attempted to determine the relationship between industrialization and changes in both economic and non-economic variables in the community.

Population Distribution and Size

An hypothesis accompanying industrialization is that population is rearranged and becomes concentrated around the new plant. Those studies which dealt with this question confirmed this assumption. In Charlotte County, Virginia, there occurred a very slight increase in the number of people living in the town where the new plant

was located.[1] In Choctaw County, Oklahoma, the proportion of the population living in the towns grew by more than one-third during the study period.[2] Such figures can be misleading. In another study, comparisons between experimental (industrialized) and control (non-industrialized) communities showed that the communities experienced growth at approximately the same rate.[3] Industrialization seemed to have little effect on urbanization levels. The evidence from some studies suggest that increased urbanization might follow industrialization. However none of the studies reviewed provided information on rates of natural increase, net migration, or county population distribution. Thus while a redistribution of population might accompany industrialization, to conclude a cause-effect relationship might not be appropriate.

In many instances, the towns containing the plant, or those located nearest to the factory grew, while the

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[1]Bureau of Population and Economic Research, The Impact of Industry in a Southern Rural County: Changes in Road Use, Travel Habits and Socioeconomic Characteristics in Charlotte County, Virginia, Five Years After the Establishment of a New Manufacturing Plant (Richmond: University of Richmond, 1956), p. 8.

[2]William Klein, "The Effect of Local Industrialization in a Rural Low-Income County" (master's thesis, Oklahoma State University, 1959), p. 39.

[3]Wade Andrews and Ward Bauder, The Effects of Industrialization on a Rural County: Comparisons of Social Change in Monroe and Noble Counties of Ohio. (Wooster, Ohio, 1968).

population in the surrounding county declined. This suggests outmigration from rural areas. In one study of thirteen towns, the total population increased by ninety-five percent in thirteen years, yet the total population of their respective counties decreased ten percent.[4] While these, and other studies show that population increases are more likely to occur in the cities nearest the plant, causal links between population increases and industrial growth are not explicitly suggested.

Commuting Patterns

It may be difficult for a company moving to a community to recruit all of the needed labor in the immediate vicinity of the plant. This often results in some of those hired becoming commuters. Evidence supports the belief that some workers who initially commute long distances later move closer to the plant. Lonsdale reported that one-fourth of the employees in a plant had moved closer to it since beginning work.[5] In a study of six Wisconsin cities, it was found that farmers who go to work in factories commute in the short run and in the long run move to town.[6]

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[4]John L. Dietz, "Rural Area Development: Analysis of the Impact of New Factories on Agricultural Towns in the Northern Great Plains," Great Plains Rocky Mountain Geographical Journal 1 (1972): 21.

[5]Richard E. Lonsdale, "Two North Carolina Commuting Patterns," Economic Geography 42 (April 1966): 130.

[6]R. B. Andrews et. al., The Effects of Industrialization on Six Wisconsin Cities (Madison, Wisconsin: Wisconsin Business Research Council Committee for Economic Development, 1959), p. 55.

Although different approaches have been used to determine commuting distances, the most frequently used is distance in miles. Wide variances were found from one study to another concerning the average number of miles driven to and from work each day. The variations indicate that many factors influence commuting patterns, such as (1) city size, (2) job opportunities, (3) availability of paved roads, and (4) pay differentials between wage and salary employees.

Some studies have attempted to characterize the worker who commutes. Summers found a slight tendency for older, better-educated, higher status employees to commute short distances.[7] Somers concluded that hourly workers were more willing to commute long distances than salaried employees.[8] McElveen noted in his South Carolina study area near a large city, that black workers commuted further than whites, the limit being sixty miles, compared with five miles for white workers.[9] Other studies show a tendency for males, and farm residents to travel further to work than females and non-farm residents. None of the studies

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[7]Gene F. Summers et. al., Industrial Invasion of Nonmetropolitan America (New York: Praeger Publishers, 1976), p. 36.

[8]Gerald Somers, "Labor Recruitment in a Depressed Rural Area," Monthly Labor Review, 81 (October 1958): 1115.

[9]Jackson McElveen, Rural Industrialization in the Southeast Coastal Plain: Case Study of a New Brick Factory in Summerville, South Carolina (Washington D. C.: U. S. Department of Agriculture 1970), p. 8.

offer a complete picture of the characteristics of the commuting employee. They do offer insights into commuting patterns and the type of employee apparently willing to commute longer distances.

Direct Employment

Creating new job opportunities is an important part of any campaign to bring new industry into a community. The establishment of manufacturing plants is expected to aid the local community directly by hiring workers from the existing labor force.

An assumption underlying many of the promotion campaigns of local chambers of commerce has been that workers will be recruited from the ranks of the community's disadvantaged: the unemployed, minorities, and the poor. Several studies addressed this question and found this hypothesis had to be rejected. Summers studied the efforts made by companies to hire the unemployed. In the thirteen communities studied he found that the percent of jobs filled by previously unemployed persons ranged from 1.0 percent to 43.0 percent. The mean percentage of jobs filled by the unemployed was 12.7 percent and the median 9.5 percent.[10] A study of new industry in the Appalachia and Ozark area found that twenty percent of the new jobs were filled by persons whose previous income was below poverty level. This was in sharp contrast to a study of new industry in the

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[10]Summers et. al., Industrial Invasion, p. 49.

Mississippi Delta area where fifty percent of the persons hired previously had incomes below the poverty level.[11] These and other studies confirmed that the higher-skill, higher wage firms attracted a small number of unemployed or poor individuals. Thus even in areas with high poverty and unemployment rates, increased manufacturing activity will do little to alleviate these problems unless the skill level required by the new jobs and of the surplus labor are carefully matched. This effort was rarely made in the studies reviewed.

Some studies investigated the impact of industrialization on the employment of blacks. In a plant in Chickasaw County, Mississippi no blacks were hired to fill the newly created one-hundred thirty jobs, even though fifty-three percent of the county was black.[12] The only study reviewed which considered several communities and drew conclusions about overall tendencies for the employment of non-whites in manufacturing was conducted by James Walker. His major finding was that

> . . . blacks did not share equitably in the economic growth and development in the Deep South. Even though they represented forty percent of the population in 1960, blacks captured only sixteen percent of the non-agricultural employment

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[11] John A. Kuehn et. al., Impact of Job Development on Poverty in Four Developing Areas (Washington, D. C.: U. S. Department of Agriculture, 1970), p. 63.

[12] George Wilbur and Sheridan Maitland, Industrialization in Chickasaw County, Mississippi (Mississippi State: Mississippi State University, 1963), p. 28.

> growth between 1960 and 1970, or 68,000 out of 429,000 new jobs. With the continuing large declines in black agricultural employment, the result was a net loss of over 97,000 jobs while whites simultaneously gained 287,000 jobs.[13]

Two reasons were often cited for the low number of jobs which are filled by the disadvantaged. First, frequently the new jobs are taken by persons from outside the immediate area--either immigrants or commuters from other communities. Often these individuals possess a higher educational level and skill level than local residents. This seems to be particularly true in non-metropolitan communities. Second, some of the studies show that it is not uncommon for jobs to be filled by new entrants in the job market from within the community, in many cases by women who had not been employed before. Scott and Summers found that increased labor force participation is often accompanied by increased unemployment.[14] In general, Summers concludes that local labor markets operate in ways which often work against the needs of the people for whom industrial development has been promoted.[15]

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[13]James Walker, Economic Development, Black Employment, and Black Migration in the Nonmetropolitan Deep South (Austin, Texas: Center for the Study of Human Resources, 1973), p. 57.

[14]John Scott and Gene Summers, Problems in Rural Communities after Industry Arrives (Ames, Iowa: Iowa State University Press 1974), p. 11.

[15]Summers et. al., Industrial Invasion, p. 54.

Multiplier Effect

One of the benefits resulting from the introduction of new industry into an area is the creation of additional jobs in other sectors of the local economy, such as retail and wholesale trade and service industries. This is referred to as the employment multiplier. A widely used figure is that of 1.65, used by the U. S. Chamber of Commerce.[16] This figure means that for every 1 2/3 jobs created in manufacturing, one new non-manufacturing job will be created. However this figure has been questioned by some scholars. The following criteria were used in the selection of communities for the study:

1. Manufacturing employment must have more than doubled in a ten year period, with a numerical increase of over one-thousand employees

2. Manufacturing employment was more than twenty percent of total employment

3. The major employment change during the ten year study period was an increase in manufacturing

4. The county was neither a part of, nor adjacent to, a metropolitan area.[17]

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[16]Chamber of Commerce of the United States, What New Industrial Jobs Mean to a Community (Washington, D. C.: Chamber of Commerce of the United States 1973), p. 7.

[17]Ibid., p. 3-4.

Summers questioned the motives behind the use of these criteria in selecting communities for the Chamber of Commerce study. He found in a review of 18 case studies that over one-half had much lower multipliers (less than 1.2), with a mean multiplier of 1.30.[18]

Many factors are influential in determining multiplier effects. Of prime importance is the size of existing manufacturing, commercial, and service industries in the area. Those communities which do not have an established diversified economy fail to gain many indirect jobs through increased business activity. One reason cited for less diversified communities having lower multipliers is that the likelihood of commuters increases. If is suggested in several studies that commuters usually spend much of their salaries in their place of residence rather than their place of employment.[19] This is frequently referred to as an industrial employment leakage. Other factors which reduce the effect of employment multipliers are the presence of underemployment and excess business capacity. When one or both of these conditions exist, firms can handle increases in sales without hiring additional workers or increasing their productive capacity.

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[18]Summers et. al., Industrial Invasion, p. 55.

[19]Ibid., p. 57.

The nature of the industry will also be influential in the creation of new non-manufacturing jobs. "Large multipliers can be expected from new industries having considerable interdependence among existing local business and industries, because they indirectly create jobs."[20] Yet when a company is dependent upon external markets both for its raw material and its finished product, the impact on non-manufacturing jobs can be negligible. In one study of a missle fuel manufacturing plant in Box Elder County, Utah, the authors concluded, ". . . when the manufacturing sector is heavily oriented to space and defense type manufacturing, and when nearly all of the raw materials are imported and the product is either tested or exported, there is little interaction at the county level."[21]

Unemployment

Reducing unemployment is often given as a reason for bringing new manufacturing plants into a community. There exists evidence that industrialization may indeed reduce unemployment, especially in those areas where

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[20]George Brinkman, "Effects of Industrializing Small Communities," Journal of Community Development Society 4 (January 1973): 72.

[21]J. Wayne McArthur and Robert O. Coppedge, "Employment Impacts of Industrial Development: A Case Study of Box Elder Lake City, Utah," Utah Economic and Business Review 29 (February 1969): 6.

unemployment is high. On the other hand, some studies have shown that unemployment may actually increase, particularly in those areas where unemployment has traditionally been low (less than 4.5 percent). Increases in unemployment have been more likely in those communities which depend on one or two factories to provide the jobs, especially in communities with less diversified economies. Crecink reported that unemployment rose by twenty workers in the county which he studied, and that total employment decreased by 190.[22] Davis found that Searcy, Arkansas, which had experienced a rapid rate of industrial growth from 1956 to 1960, had more persons unemployed in 1959 than were reported in the total labor force in 1956.[23] These findings suggest the need for the development of a diversified economy and the planning for longer-run implications of increased industrial activity.

Income

For the most part, existing evidence supports the assumption that industrialization brings about an increase in per capita income. Most studies express increases in

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[22]John Crecink, Rural Industrialization: Case Study of a Tissue Paper Mill in Pickens, Mississippi (Washington, D. C.: United States Department of Agriculture 1970), p. 27.

[23]James N. Davis, Jr., "Effects of Industrialization upon the Economy of Searcy, Arkansas: A Case Study" (Ph.D. dissertation, University of Arkansas, 1963), p. 9.

incomes in percentages after adjusting for inflation. It is not surprising to find that some of the highest increases occurred in those communities which previously had some of the lowest per-capita incomes of all study areas. In such areas, even small absolute increases would result in large percentage increases. Summers suggests three reasons which appear to be widely responsible for small increases in incomes.

1. The existence of a large amount of commuting, both by non-residents into the county for work, and residents out of the county for purchases

2. The high number of lower paying industries in the new plants--such as apparel and textiles

3. The fact that small increases seem to accompany companies in industries which import raw materials and export their finished product.[24]

While there is evidence that the per-capita income may increase following industrialization, a question not addressed by most studies is: "Whose income increases?" Few studies have addressed the question of how the additional income is distributed in the community.

Some that have attempted to answer this question have found that industrialization has had some negative effects on certain groups in the community. Clemente and

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[24]Summers et. al., Industrial Invasion, p. 63.

Summers found that the construction of a large steel mill in Illinois had a negative effect on the relative income status of the elderly residents of the area.[25] According to Till, in a study of industrialization in the South, companies in historically lower-paying industries were attracted to the region, thus adding little net gain in income to the residents.[26] Several studies concluded that while development may indeed raise the aggregate income, it may simultaneously depress the relative economic status of other groups such as the handicapped, elderly, and minorities. Most of the studies concluded that much of the benefit of industrialization has accrued to those who moved to the area after development had begun. In many cases the immigrants were younger and better educated, thus possessing an advantage in the competition for present and future jobs. Summers suggests that the people who bear the cost of development, such as increased taxes for land development, may not be the same people who will capture the benefits, and in fact may find themselves in a worse relative position after development.[27]

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[25]Frank Clemente and Gene F. Summers. "A Comment on Palmore and Whittington's Relative Status of the Aged," Social Forces 51 (June 1973): 494.

[26]Thomas Till, "Extent of Industrialization in Southern Labor Markets in the 1960's," Journal of Regional Science 13 (December 1973): 457-60.

[27]Summers et. al., Industrial Invasion, p. 70.

Private Sector Impact

The creation of new jobs and additional income can be seen in other industries in the private-sector economies of communities. These secondary and tertiary effects are less easily identified, but are recognized in almost all of the studies reviewed.

Wages and salaries paid by new industry are beneficial to the extent that the plant's payroll is paid to persons who spend it in the community. In almost all cases, a certain proportion of the total payroll will be spent for goods and services in neighboring communities. Wadsworth and Conrad reported that the average weekly payroll was reduced by twenty percent through leakage to surrounding communities.[28]

Few studies were able to document leakage as exactly as were Wadsworth and Conrad. However, it was agreed by all that leakages do occur, thus reducing gains in aggregate disposable income.

One segment of the economy expected to receive benefits from industrialization is the construction industry. Most of the case studies reveal increased construction activity following industrial development. It is further

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[28] H. A. Wadsworth and J. M. Conrad, "Leakages Reducing Employment and Income Multipliers in Labor Surplus Rural Areas," Journal of Farm Economics 47 (December 1965): 1199.

apparent that the number of new homes a community may expect for a given number of new jobs cannot be predicted unless additional characteristics of the community are considered.

If a community has little competition from neighboring communities in providing housing for workers, it can expect a relatively higher residential construction rate. The composition of the work force is also important. If the new industry employs many female workers, as many companies in the clothing industry do, there may be little or no new home construction.[29]

Increases in the construction of commercial buildings were frequently found to accompany increased manufacturing activity. In their study, Andrews et al. found that the more industrialized cities reported a substantially larger growth in the number of retail establishments than was found in the less industrialized cities.[30] Davis reported that between 1951 and 1959, nearly three million dollars in commercial construction occurred in Searcy, Arkansas.[31]

Increases in disposable personal income may generate indirect and induced growth in other areas of the

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[29]Scott and Summers, Problems, p. 60.

[30]Andrews et. al., "Effects of Industrialization," p. 60.

[31]Davis, "Effects of Industrialization," p. 111.

commercial sector, such as retail business, real estate, insurance and banking. Such growth is another example of the multiplier effect, involving a transformation of personal income into commercial expansion. A factor which might tend to minimize the impact of commercial development is the existence of excess capacity in existing commercial establishments.[32]

The growth in disposable income following industrialization, in all cases studied, generated greater retail sales. However, in none of the studies was there an attempt to identify what portion of the increase should be attributed to new industry. Direct, indirect, and induced sales were not disaggregated. This problem with the methodology is perhaps more easily understood than the fact that several studies did not contain a statement regarding inflation, and whether or not the comparisons of dollar volume over time were in constant or current dollars. Despite these and other less serious weaknesses, it does seem fair to conclude that increased industrial activity does result in gains in private-sector economic variables. Whether or not these gains are translated into public-sector gains large enough to meet increased public-sector costs is less clearly addressed in most of the studies.

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[32]Wadsworth and Conrad, Leakages, p. 1201.

Public Sector Revenue

New industry provides benefits to the local public sector economy, in the form of direct payments. These direct payments will be dependent upon the local tax structure and agreements between the local government and industrial management.

Wide differences were found in the amount of direct tax revenue received, in those studies reviewed. Uhrich found that the Metal Products Division of the 3M Company paid a total of $113,808.58 in property taxes to the Brookings, South Dakota, city government and school district in 1973.[33] On the other hand, Bucher found that four of the seven mid-western communities he studied received no tax revenue from companies which they had spent funds to encourage to locate in their municipality.[34] Similarly, in three of the eight Kentucky communities studied by Garrison, no tax revenue was collected.[35]

Several cases studied the impact of new industry on property tax rates. Revenue can be increased or decreased

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[33]Dwight G. Uhrich, "Economic Impact of New Industry on the Brookings Community" (master's thesis, South Dakota State University, 1974), p. 44.

[34]Norman J. Bucher, Impact of New Industrial Plants: Eight Case Studies (Jefferson City, Missouri: University of Missouri 1971), pp. 12-48.

[35]Charles B. Garrison, "Economic Impact of New Industry on Small Towns" (Ph.D. dissertation, University of Kentucky, 1967), pp. 51-164.

by changes in assessment ratios, tax rates, or both. Local governmental officials make decisions regarding these variables, and are subject to political pressures in addition to market forces. Some cities reported an increase in tax rates, some reported no change, and others reported a decrease in tax rates. From the studies reviewed, it seems that new industry does not provide any predictive value for tax rates.

Increases in disposable income may also result in increases in service fees.[36] Brady found that Wynne, Arkansas, increased its revenue from 1960 to 1970 by 251.6 percent. Court fines and auto license fees accounted for the majority of the increase. Total revenue from the publicly owned water department increased ninety-seven percent, while the per capita increase was 5.88 percent.[37] Ava, Missouri, which owned the water and sewer facilities and the electrical utilities, enjoyed an increase in service fee revenue. Combined water and sewer receipts increased by over sixty percent in the post-industrial period over those received prior to industrialization. Revenue from

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[36]Examples of what is meant by service fees are admission fees to publicly owned recreation facilities, rental fees for use of publicly owned land, facilities, or equipment, and service charges made by public hospitals.

[37]Guy Brady, "The Impact of Industrialization on a Rural Town Economy: Wynne, Arkansas" (master's thesis, University of Arkansas, 1974), p. 80.

sale of electricity increased by over ninety percent, and net income from electricity sales increased by over 185 percent.[38] Other studies showed similar findings. Most consistent in providing revenue were the publicly owned utilities.

Increased manufacturing activity may also have an impact on the revenue received by local communities, in the form of transfer payments from state and federal governmental agencies. Most of the studies attempted to analyze this flow of funds. However, most were somewhat less than successful in determining the total flow originating from industrial development. The local school district of Ava, Missouri, received $96,224 in state and federal aid in 1953. By 1964, their combined contribution had increased to $329,556.[39] The city of Wynne, Arkansas, enjoyed an increase of 1,575 percent in state aid from 1960 to 1970. In 1960, state aid made up 31 percent of Wynne's total income. This figure had increased to 42 percent by 1970. Federal contributions to the public school system increased by 1,138 percent over the same time period.[40]

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[38]Dale Hagerman and Curtis Braschler, Part Two: An Analysis of the Impact of Industrialization on Local Government. A Case Study of Ava, Missouri (Columbia, Missouri: University of Missouri 1966), pp. 75-81.

[39]Ibid., p. 91.

[40]Brady, "Impact of Industrialization," p. 84.

All of these studies would lead one to believe that increased transfer payments would follow industrial development. They also suggest a greater reliance by communities on state and federal aid. This might be explained by the statutory limitations which restrict local officials from directly receiving revenue from the public. Property taxes are practically the only such mechanism available.[41]

Most industrial impact cases studied reported increased local government revenue following new manufacturing activity. However, most are much less clear in their attempt to identify the proportion which can be directly attributed to new industry. Increases in direct tax revenue, property valuation, service fee receipts, and transfer payments consistently occurred. Most were less clear in their analysis of increased public sector costs, which are essential in determining the total impact on the public sector.

Public Sector Costs

Frequently communities spend money to make themselves attractive to companies considering a new location for a plant. Examples of such costs are site preparation, road improvement, utility and water and sewer connections,

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[41] Summers, et. al., Industrial Invasion, p. 91.

and advertising expenses to attract industrial attention. In addition to these mentioned, it is not uncommon to allow a new company to pay lower tax rates than normal, or perhaps even no taxes for a specified period of time. This is appropriately referred to as a tax holiday.

Additional costs often occur after a firm has begun operations. Examples of such costs are utility and water and sewerage service, police and fire protection, and road maintenance.[42] If the payments made by the new company for these services are not at least equal to the costs of such services, then the community has engaged in another form of subsidy.

Environmental costs also have been considered. Long-term costs are associated with the operation of a manufacturing plant, particularly noise, air, and water pollution. Most studies that attempted to address this issue had trouble in translating such costs into precise dollar measurements.

In many studies it was shown that new industry is associated with increases in the public-sector costs of delivering basic services to residents. Utility costs, especially water and sewerage, were found to be one of the primary sources of increased costs. Daoust found that development overloaded the municipal water system,

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[42]Ibid., p. 93.

resulting in contaminated water and making necessary the construction of a new plant.[43] Following industrial expansion, Rockdale, Texas, was forced to drill a new municipal well and issue bonds for sewerage line extension.[44] Wynne, Arkansas, found it necessary to expand its sewerage facilities, resulting in an increase in expenditures of $789,229 (adjusted for inflation).[45]

Frequently proponents of industrialization argue that existing excess capacity in utility or water and sewerage systems exists, and that new companies will result in increased revenue, with little or no additional costs. These and other studies imply that local officials often make errors in estimating the amount of existing excess capacity. It appears that it is common for the development to bring about an overload in existing systems, resulting in the spending of public funds.

Additional school services are often required following industrial expansion. Some of these costs are recovered through increased transfer payments and tax receipts. Increased revenue were much more easily identified

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[43]Charles F. Daoust, "Transition in Central Michigan, Agriculture to Industry" (master's thesis, University of Chicago, 1954), p. 22.

[44]John Garth. "When Big Business Comes to a Country Town: Why Alcoa Spent $80,000 Near Rockdale, Texas." American Business, March, 1953, pp. 37-40.

[45]Brady, "Impact of Industrialization," p. 84.

than were increased costs, which could be directly tied to industrialization.

Few studies addressed the net gain to the public sector economy, the difference between revenue and costs resulting from new industry. Primary emphasis seems to have been placed on the benefit side, which is easier to calculate than costs. In the five towns and eight plants studied by Garrison, it was found that only two of the companies produced more revenue than that generated by the property prior to the plants' construction. In six of the eight plants, costs to the local government exceeded additional revenue. Garrison felt that a combination of available local labor, a large non-tax incentive, and a property tax holiday minimized the additional revenue.[46] In attempting to determine the net impact, Shaffer reported large gains to the public economy to be so small that he would not accept the hypothesis that new industry greatly expanded the fiscal base of a community. For example, one community experienced a net gain to the private sector of $922 million, while the public sector enjoyed a net benefit of $152,981. In almost all cases the private sector experienced a gain, while almost thirty-five percent of the companies resulted in a net loss to the public sector.[47]

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[46]Garrison, "Economic Impact," pp. 161-63.

[47]Ronald Shaffer, "The Net Economic Impact of New Industry on Communities in Eastern Oklahoma" (Ph.D. dissertation, Oklahoma State University, 1972), pp. 64-74.

Summary

Most industrial impact studies are consistent in showing gains in those economic variables which are more easily measurable, such as personal income, tax receipts, secondary business activity, and inter-governmental transfer payments. Not as widely discussed and identifiable are other factors which make industrialization less attractive than proponents might have one believe. Examples of these variables are income leakage, possible increases in unemployment and taxes, lower environmental and quality-of-life standards, and increases in the expenditure of public funds following industrial growth. The more valuable studies appear to be those that have attempted to address both sides of this complex issue.

CHAPTER IV

ANALYSIS OF INDUSTRIAL IMPACT

The purpose of this chapter is to present a detailed description of the analysis and a discussion of the quantitative techniques used to accomplish the objectives of this study.

Design of the Model

After extensive research, the factors discussed in chapter 2 were selected to be used in this study. Following the definition of industrialization in chapter 1, at least two alternatives were available as the variable used to measure the amount of industrial growth that occurred during the study period: (1) the number of people employed by manufacturing organizations, (2) the percentage of people in the total labor force employed by manufacturing companies. The latter would be preferable, since it states the variable in relative terms. However, the percentage of people employed in manufacturing was available only since 1970.[1] Due to the fact that much of the industrialization that has occurred took place after that year, it was

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[1]Interview with David Padgett, Texas Employment Commission, Wichita Falls, Texas, 12 May 1978.

determined that more data was required, particularly for years prior to the more rapid growth years after 1970. For these reasons it was determined that the appropriate measure for induatrialization would be the number of persons employed by companies engaged in manufacturing.

Bivariate correlation and multiple regression techniques were used to test the relationship between industrialization and the variables discussed in chapter 2, which were selected to represent activity in both the private and public economies.

Per Capita Income

Almost all industrial impact studies reviewed reported that as new manufacturing jobs were created, the average income of community residents increased. This relationship is fundamental to all community campaigns to persuade local residents of the benefits of increased manufacturing activity.

To test the relationship between industrialization and per capita income, bivariate correlation analysis was used. Bivariate correlation provides a correlation coefficient, which summarizes the strength of the association between a pair of variables, in this instance industrialization and per capita income. Income was adjusted for inflation for each of the years by dividing the per capita income value by the consumer price index. The variables used for this test are summarized in table 5.

TABLE 5

MANUFACTURING JOBS, PER CAPITA INCOME AND ADJUSTED PER CAPITA INCOME FOR WICHITA FALLS, TEXAS, STANDARD METROPOLITAN STATISTICAL AREA, 1962-1977

Year	Number of Persons Employed by Manufacturing Companies	Per Capita Income (dollars)	Per Capita Income Adjusted for Inflation (dollars)
1962	3135	1,992	2,199
1963	3147	2,030	2,214
1964	3243	2,190	2,357
1965	3385	2,344	2,480
1966	3235	2,253	2,318
1967	3291	2,380	2,380
1968	3354	2,554	2,451
1969	3857	2,807	2,445
1970	4560	2,990	2,571
1971	4990	3,139	2,588
1972	5340	3,348	2,672
1973	6110	3,699	2,779
1974	6910	4,273	2,893
1975	7140	4,742	2,942
1976	7500	5,302	3,110
1977	8090	NA	NA

Sources: Texas Employment Commission, Manpower Trends, 16 volumes (Wichita Falls, Texas, 1962-1977), passim.; and "Survey of Buying Power," Sales Management, 16 volumes (1962-1977), passim.

From table 5 it can be seen that per capita income has shown an increase over the study period. Adjusted per capita income increased by over 41 percent. The relationship between this increase and industrialization is illustrated in table 6 and figure 3. A strong positive linear relationship between per capita income and industrialization is present.

TABLE 6

SUMMARY OF BIVARIATE CORRELATION FOR INDUSTRIALIZATION AND PER CAPITA INCOME

Coefficient of correlation (r)	.96
Coefficient of determination (r^2)	.93

The simple r (.96) shows that there is a strong positive linear relationship. The r^2 gives a more easily interpreted measure. This figure, known as the coefficient of determination, measures the percentage to which the variance in the dependent variable is determined by the independent variable.[2] Thus over 92 percent of the variance in per capita income can be explained by variance in the number of manufacturing jobs.

To check for the presence of autocorrelation, a further test was conducted. Wesolowski defines

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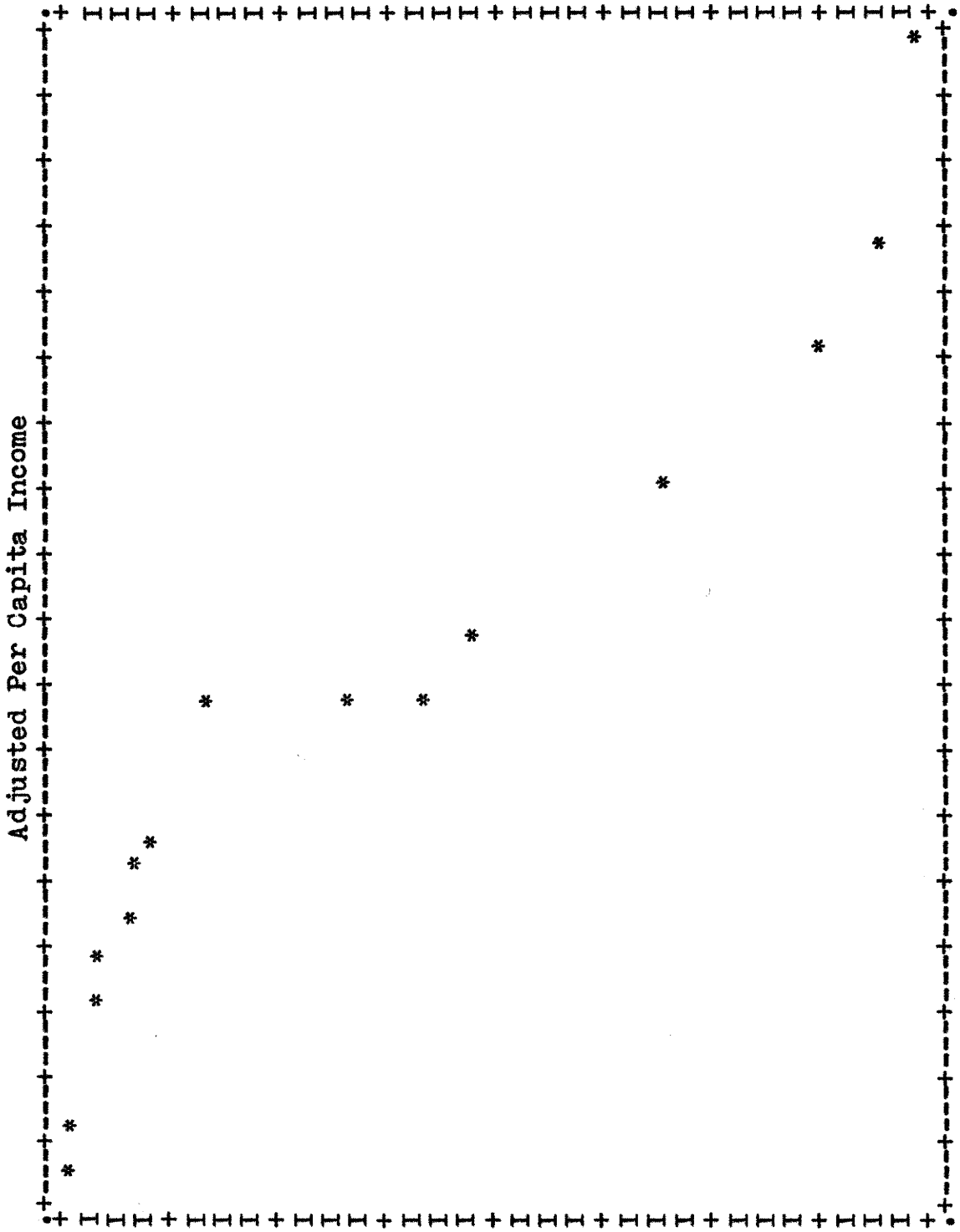
[2]Mordecai Ezekiel and Karl A. Fox, Methods of Correlation and Regression Analysis (New York: John A. Wiley & Sons, Inc., 1959), p. 130.

Figure 3. Relation of Adjusted Per Capita Income to Manufacturing Employment as Shown by Individual Observations



autocorrelation as the statistical dependence of errors on preceding errors.[3] Autocorrelation occurs frequently in data taken from observations that occur over a period of time, as do the data for this study. Von Neuman's ratio was calculated from the data presented in table 83, which is located in the Appendix, and was found to be 1.21. This figure shows that significant autocorrelation does not exist in the residuals; thus the usual standard error formulas do apply.

The existence of a strong positive correlation between industrialization and per-capita income is critical to any study attempting to determine the costs and benefits of expanded industrial activity in more than one respect. First, per-capita income is an important indicator of the economic health of the community, as well as the quality of life for its residents. Second, it is important to consider the impact of increased income on other areas of the economy, both the private sector and public sector. This multiplier effect is crucial to impact studies and is examined in the following sections.

Private Sector Activity

Three areas of the private sector were selected to determine the relationship between industrialization and

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[3]George O. Wesolowski, Multiple Regression and Analysis of Variance (New York: John Wiley and Sons, 1976), p. 136.

increased business activity; retail business, real estate/ construction, and banking. Data from these industries were selected and multiple regression techniques were used to test the relationship with industrialization and income.

To test for the existence of multicollinearity, forward (stepwise) inclusion of the independent variables (per capita income and manufacturing jobs) was used. Multicollinearity refers to a situation whereby independent variables are highly intercorrelated.[4] Multicollinearity can cause computational difficulties and errors in the calculation of coefficients. The presence of multicollinearity prevented the application of both per capita income and manufacturing jobs as independent variables in a multiple regression.

Also, the model proposes that there is a weak causal relationship between industrialization, per capita income, and the dependent variables, and forward inclusion is appropriate in such cases. When forward inclusion of the variables is used, the order of inclusion is determined by the contribution of each independent variable to explained variance.

Retail Sales

Retail sales for Wichita Falls for the study period are shown in table 7. Sales figures were adjusted for

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[4] John Neter and William Wasserman, Applied Linear Statistical Models (Homewood, Illinois: Richard D. Irwin Inc., 1974), p. 250.

TABLE 7

RETAIL SALES FOR WICHITA FALLS, TEXAS, 1962-1977

Year	Sales (millions of dollars)	Sales Adjusted for Inflation (millions of dollars)
1962	141,514	156,196
1963	150,748	164,393
1964	154,994	166,840
1965	166,850	176,561
1966	170,810	175,730
1967	176,211	176,211
1968	192,367	184,613
1969	207,500	188,980
1970	227,489	195,605
1971	231,281	190,669
1972	272,677	217,619
1973	324,892	244,096
1974	330,125	223,511
1975	424,452	263,308
1976	420,604	246,689
1977	NA	NA

Source: "Survey of Buying Power," Sales Management, 16 Volumes (1962-1977), passim.

inflation by dividing sales figures by the consumer price index in order to use constant dollars.

The results of the calculations when manufacturing jobs were regressed with adjusted retail sales are summarized in table 8.

TABLE 8

REGRESSION: DEPENDENT VARIABLE--RETAIL SALES, INDEPENDENT VARIABLE--MANUFACTURING JOBS

Statistic	Value
Coefficient of correlation	.95
Coefficient of determination	.89
Adjusted coefficient of determination	.88
Standardized regression coefficient	.95
F	100.98
Durbin-Watson test	2.43

The independent variables (manufacturing jobs and per capita income) are highly interrelated, as evidenced by the Pearson r of .93 in table 6 and the tolerance value (.06) for the regression. The presence of multicollinearity prevented a further analysis of the relationship between retail sales and both manufacturing jobs and per capita. As can be seen from table 8, there is a strong positive linear relationship between manufacturing jobs

and retail sales. The correlation coefficient for retail sales and per capita income was found to be .93. These represent a significent relationship between retail sales and both manufacturing jobs and per capita income.

The Durbin-Watson statistic for the residuals was 2.43, indicating no significant autocorrelation. The plot of residuals from which the calculations were made is shown in figure 4, which is located in the Appendix.

Forward inclusion of the independent variables indicated that there was a stronger correlation between manufacturing jobs and retail sales than that between per capita income and retail sales. However, there was also a significant relationship between per capita income and retail sales. A summary of the statistics calculated is shown in table 9. There was no evidence of the existence of significant autocorrelation in the residuals.

Real Estate

To examine the relationship between industrialization and real estate, two dependent variables were selected: number of houses sold, and the inflation adjusted mean price of houses sold. These values for the study period are shown in table 10. The adjusted mean sales price was used for all calculations.

Multicollinearity prevented the use of both manufacturing jobs and per-capita income in a multiple

TABLE 9

REGRESSION: DEPENDENT VARIABLE--RETAIL SALES, INDEPENDENT VARIABLE--PER CAPITA INCOME

Statistic	Value
Coefficient of correlation	.93
Coefficient of determination	.87
Adjusted coefficient of determination . . .	.86
Standardized regression coefficient	.93
F	78.73
Durbin-Watson test	2.72

TABLE 10

NUMBER AND MEAN PRICE OF HOUSES SOLD IN WICHITA FALLS 1962-1977

Year	Number of Houses Sold	Mean Price (dollars)	Mean Price Adjusted for Inflation (dollars)
1962	261	10,770	11,887
1963	181	11,868	12,942
1964	193	11,580	12,465
1965	156	11,883	12,575
1966	148	13,362	13,747
1967	194	13,158	13,158
1968	204	13,717	13,164
1969	334	14,377	13,094
1970	349	15,310	13,164
1971	543	16,070	13,248
1972	801	17,096	13,644
1973	1,026	18,986	14,265
1974	1,279	19,846	13,437
1975	1,489	21,424	13,290
1976	1,542	24,214	14,202
1977	1,934	26,908	14,817

Source: Wichita Falls Board of Realtors, Wichita Falls, Texas, correspondence of April 8, 1978. (Typewritten).

regression. A significant positive linear relationship exists between manufacturing jobs and the mean sales price of houses. A summary of the calculations is shown in table 11. Significant autocorrelation was not present as indicated by the Durbin-Watson statistic. A plot of the residuals is shown in figure 5. While the relationship is not as strong as some of those previously discussed, it is significant at a level of significance of .05.

TABLE 11

REGRESSION: DEPENDENT VARIABLE--ADJUSTED MEAN SALES PRICE OF HOUSES, INDEPENDENT VARIABLE--MANUFACTURING JOBS

Statistic	Value
Coefficient of correlation	.64
Coefficient of determination	.41
Adjusted coefficient of determination	.36
Standardized regression coefficient	.64
F	8.28
Durbin-Watson test	1.39

The first regression calculation for the number of houses sold and the number of manufacturing jobs showed significant autocorrelation (Durbin-Watson statistic = .80). To compensate for the presence of significant autocorrelation, yearly percentage changes rather than actual data were

used.[5] The actual data, as well as the percentage changes, are shown in table 12. After adjusting for autocorrelation, the coefficient of correlation was .51 and the calculated F value was 4.57, indicating the absence of a significant linear relationship between the number of houses sold and the number of persons employed in manufacturing jobs.

Home Construction

The number of new home building permits was used to determine the relationship between manufacturing activity and new home construction. The number of approved building permits for the study period is shown in table 13.

A summary of the correlation analysis calculations is shown in table 14. The F value (5.03) indicates that the linear relationship is significant at the .05 level of significance. The coefficient of correlation shows that there is a positive linear relationship between the two variables. The coefficient of determination indicates that 30 percent of the variation in housing starts is explained by linear regression on the manufacturing jobs variable. Significant autocorrelation is not present, as indicated by the Durbin-Watson test statistic (1.38). The plot of the

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[5]For a discussion of this technique see Spurr and Bonini, Statistical Analysis, pp. 478-81.

TABLE 12

NUMBER OF PERSONS EMPLOYED BY MANUFACTURING COMPANIES AND NUMBER OF HOUSES SOLD IN WICHITA FALLS, TEXAS 1962-1977

Year	Number of Persons Employed by Manufacturing Companies (X)	Number of Houses Sold (Y)	Percent Change from Previous Year	
			X	Y
1962	3,135	261	-----	-----
1963	3,147	181	.383	-30.651
1964	3,243	193	3.051	6.630
1965	3,385	156	4.379	-19.171
1966	3,235	148	-4.431	- 5.128
1967	3,291	194	1.731	31.081
1968	3,354	204	1.914	5.155
1969	3,857	334	14.997	63.725
1970	4,560	349	18.227	4.491
1971	4,990	543	9.430	55.587
1972	5,340	801	7.014	47.514
1973	6,110	1,026	14.419	28.090
1974	6,910	1,279	13.093	24.659
1975	7,140	1,486	3.333	16.185
1976	7,500	1,542	5.042	3.769
1977	8,090	1,934	7.867	25.422

Sources: Texas Employment Commission, Manpower Trends, 16 volumes (Wichita Falls, Texas: Texas Employment Commission); and Wichita Falls Board of Realtors, Wichita Falls, Texas, correspondence of 8 April 1978. (Typewritten).

TABLE 13

NEW HOME BUILDING PERMITS FOR
WICHITA FALLS, TEXAS
1962-1977

Year	Number of Permits
1962	NA
1963	363
1964	145
1965	160
1966	140
1967	198
1968	180
1969	181
1970	267
1971	287
1972	275
1973	304
1974	167
1975	289
1976	441
1977	447

TABLE 14

REGRESSION: DEPENDENT VARIABLE--NEW HOUSE BUILDING PERMITS, INDEPENDENT VARIABLE--MANUFACTURING JOBS

Statistic	Value
Coefficient of correlation	.54
Coefficient of determination	.30
Adjusted coefficient of determination . . .	.24
Standardized regression coefficient	.54
F	5.03
Durbin-Watson test	1.38

residuals from which the calculation was made is shown in figure 6.

Bank Deposits

To test the relationship between industrialization and banking activity, the total of inflation-adjusted deposits in Wichita Falls banks was chosen. This value, as well as the unadjusted balance is shown in table 15.

Initial calculations indicated the lack of a significant relationship between the two variables (coefficient of correlation = .04) and the presence of significant autocorrelation. To compensate for this, yearly percentage changes rather than actual data were used in the second calculations. Data for these calculations are shown in

TABLE 15

WICHITA FALLS TOTAL COMMERCIAL BANK DEPOSITS, 1962-1977

Year	Total Deposits (millions of dollars)	Adjusted for Inflation Total Deposits (millions of dollars)
1962	197,440	217,925
1963	219,182	239,021
1964	230,031	247,612
1965	245,481	259,768
1966	251,163	258,398
1967	258,172	258,172
1968	270,500	259,597
1969	270,529	246,383
1970	269,448	231,684
1971	283,369	233,610
1972	309,146	246,725
1973	325,104	244,255
1974	377,089	255,310
1975	406,418	252,120
1976	444,033	260,430
1977	475,932	262,077

Source: City National Bank, Wichita Falls, Texas, correspondence of 20 April 1978. (Typewritten).

table 16. After adjusting for autocorrelation, a significant relationship was not found between total bank deposits and the number of persons employed by manufacturing firms. A summary of the statistics is shown in table 17.

Private-Sector Jobs

A crucial aspect of the model deals with the phenomenon of job creation. As new manufacturing stimulates personal income and business activity in other sectors of the economy, the process leads to demand for individuals to fill jobs in other industries. To test the relationship between industrialization, per capita income, private-sector activity, and private-sector jobs, three categories of jobs were included in multiple regression analysis. Data were provided by the Texas Employment Commission for the study period for the number of persons employed in (1) construction, (2) finance, which includes banking, real estate and insurance, and (3) retail trade.

It is generally accepted that several factors working together will determine the number of jobs in various sectors. In order to determine which factors were more significant, variables previously discussed in this chapter were used as independent variables to determine their impact on jobs in the private sector. The existence of multicollinearity presented serious problems in this analysis. The coefficients of correlation for the independent

TABLE 16

NUMBER OF PERSONS EMPLOYED IN MANUFACTURING AND TOTAL BANK DEPOSITS FOR WICHITA FALLS, TEXAS, 1962-1977

Year	Number of Persons Employed by Manufacturing Companies (X)	Adjusted for Inflation Bank Deposits (millions of dollars) (Y)	Percent Change from Previous Year	
			X	Y
1962	3,135	217,925.13	-----	-----
1963	3,147	289,020.95	.383	9.680
1964	3,243	247,611.89	3.051	3.594
1965	3,385	249,768.09	4.379	4.909
1966	3,235	258,398.37	-4.431	-.527
1967	3,291	258,171.80	1.731	-.088
1968	3,354	249,597.26	1.914	.552
1969	3,857	246,383.15	14.997	-5.090
1970	4,560	231,683.68	18.227	-5.966
1971	4,990	233,609.95	9.430	.831
1972	5,340	246,724.51	7.014	5.614
1973	6,110	244,255.46	14.419	1.000
1974	6,910	255,307.59	13.093	4.525
1975	7,140	252,120.06	3.333	-1.249
1976	7,500	260,429.67	5.042	3.296
1977	8,090	262,077.04	7.867	.633

Sources: City National Bank, Wichita Falls, Texas, correspondence of 20 April 1978 (Typewritten); and Texas Employment Commission, Manpower Trends, 16 volumes (Wichita Falls, Texas: Texas Employment Commission).

TABLE 17

REGRESSION: DEPENDENT VARIABLE--BANK DEPOSITS, INDEPENDENT VARIABLE--MANUFACTURING JOBS

Statistic	Value
Coefficient of correlation	-.43
Coefficient of determination	.18
Adjusted coefficient of determination	.12
Standardized regression coefficient	-.43
F	2.94
Durbin-Watson test	1.37

variables can be seen in table 18. As can be seen, many of the variables are inter-correlated with other independent variables. In order to compensate for the presence of multicollinearity, forward step-wise inclusion of the independent variables was used. In addition, only those independent variables which resulted in an F value of 1.5 or greater and a tolerance level of .20 or greater were entered into the equation. The F value restraint limited the introduction of variables to those which potentially added significantly to the relationship. The tolerance level is used to identify those independent variables which are highly correlated with the variables in the equation. Thus, variables which might falsely add

significantly to the relationship because of high correlation with variables already used, were not allowed to enter the equation.

Construction Jobs

Multiple regression was performed for the independent variables shown in table 18, and construction jobs as the dependent variable. The results of step one of the multiple regression are shown in tables 19 and 20.

As can be seen from table 19, of the independent variables used, the number of houses sold was found to be the most significant in its relationship with the number of persons employed in construction. The F value (36.39) is significant at the .01 level. Table 20 shows various statistics for those independent variables not in the equation. As can be seen from the low tolerance levels, the numbers of persons employed in manufacturing, retail sales, and per capita income are highly correlated with the number of houses sold, and thus are not considered for entry into the equation in step two. A summary of the statistics calculated for step two is shown in tables 21 and 22.

Table 21 shows that variance in the number of houses sold and the number of new housing starts together accounts for seventy-nine percent of the variance in the

TABLE 18

COEFFICIENTS OF CORRELATION
PRIVATE SECTOR ACTIVITY

	Manufacturing Jobs	Bank Deposits	Houses Sold	House Prices	Housing Starts	Retail Sales	Per Capita Income
Manufacturing jobs....	1.00						
Bank deposits....	.04	1.00					
Houses sold.....	.51	.14	1.00				
House prices.....	.64	.11	.63	1.00			
Housing starts.....	.54	-.29	.54	.51	1.00		
Retail sales.....	.95	.10	.95	.68	.51	1.00	
Per capita income.....	.96	.16	.95	.60	.48	.93	1.00

TABLE 19

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--CONSTRUCTION JOBS, INDEPENDENT VARIABLE--HOUSES SOLD

Statistic	Value
Coefficient of correlation	.87
Coefficient of determination	.75
Adjusted coefficient of determination	.73
Standardized regression coefficient	.87
F	36.39

TABLE 20

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--CONSTRUCTION JOBS, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Manufacturing jobs..	.14	.05	.03	.02
Bank deposits.....	.18	.36	.98	1.68
House prices.....	.07	.12	.61	.15
Housing starts.....	-.23	-.39	.71	2.00
Retail sales.....	-.91	-.57	.10	5.17
Per capita income...	.09	.05	.09	.03

TABLE 21

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
CONSTRUCTION JOBS, INDEPENDENT VARIABLES--
HOUSES SOLD, HOUSING STARTS

Statistic	Value
Coefficient of correlation	.89
Coefficient of determination	.79
Adjusted coefficient of determination	.75
F - Houses sold	36.47
F - Housing starts	2.00
F - Final equation	20.69
Durbin-Watson statistic	3.05

TABLE 22

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
CONSTRUCTION JOBS, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Manufacturing jobs..	.22	.08	.03	.06
Bank deposits.....	.12	.23	.80	.57
House prices.....	.15	.25	.56	.66
Retail sales.....	-.92	-.62	.10	6.37
Per capita income...	-.02	-.01	.09	.00

number of persons employed in construction jobs. The F value (20.69) shows this to be significant at a .01 level of significance. The F value for housing starts (1.99) shows that when the number of houses sold is controlled, the number of housing starts does not contribute significantly to explaining the variance in the number of persons employed in construction. Significant autocorrelation is not present, as indicated by the Durbin Watson statistic (3.05).

As shown in table 22, only retail sales have an F value which would qualify for entry into the equation. However, the tolerance level of .10 indicates the presence of multicollinearity with independent variables in the equation. Thus the calculations end with step two.

Financial Jobs

The number of persons employed during the study period in banking, insurance, and real estate is shown in table 23.

Multiple regression was performed for the independent variables shown in table 18, with the data shown in table 23 as the dependent variable. The results of step one of the multiple regression are shown in tables 24 and 25.

The summarized results in tables 24 and 25 indicate that of the independent variables considered, a more

TABLE 23

PERSONS EMPLOYED IN BANKING, INSURANCE, REAL ESTATE IN WICHITA FALLS, TEXAS, STANDARD METROPOLITAN STATISTICAL AREA, L962-1977

Year	Number
1962	1,346
1963	1,269
1964	1,261
1965	1,339
1966	1,360
1967	1,356
1968	1,405
1969	1,359
1970	1,630
1971	1,610
1972	1,710
1973	1,760
1974	1,860
1975	1,910
1976	2,000
1977	2,180

Source: Texas Employment Commission, Manpower Trends--Wichita Falls, Texas, 18 volumes. (Wichita Falls, Texas, 1962-1977), passim.

TABLE 24

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--FINANCIAL JOBS, INDEPENDENT VARIABLE--MANUFACTURING JOBS

Statistic	Value
Coefficient of correlation	.98
Coefficient of determination	.96
Adjusted coefficient of determination	.96
Standardized regression coefficient	.98
F	317.81

TABLE 25

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--FINANCIAL JOBS, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Bank Deposits.....	-.01	-.06	.10	.05
Houses sold.....	-.58	-.49	.03	3.49
House prices.....	.10	.39	.59	2.00
Housing starts.....	.03	.14	.70	.21
Retail sales.....	.09	.16	.11	.28
Per capita income..	.07	.10	.06	.11

significant relationship was found between the number of persons employed in financial jobs and the number of persons employed by manufacturing companies. The coefficient of determination indicates that over ninety-six percent of the variance in the number of persons employed by financial organizations can be explained by the variance in the number of persons employed by manufacturing companies. This represents a significant positive linear relationship between the two variables. Table 25 shows statistics for those independent variables not in the equation. The low tolerance levels of per-capita income, total retail sales, and the number of houses sold indicate significant multicollinearity with the independent variable (manufacturing jobs) already in the equation, and thus were not allowed to enter into the equation during step two. Of the remaining independent variables, only housing prices show a potential contribution, and are entered into the equation during step two. A summary of the statistics calculated for step two is shown in tables 26 and 27.

The F value for the final equation shown in table 26 indicates that, together, manufacturing jobs and house prices have a significant linear relationship with the number of persons employed by financial organizations. However, when manufacturing jobs are controlled, housing prices do not add significantly to the equation, as shown by the F value for

TABLE 26

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
FINANCIAL JOBS, INDEPENDENT VARIABLES--
MANUFACTURING JOBS, HOUSE PRICES

Statistic	Value
Coefficient of correlation	.98
Coefficient of determination	.97
Adjusted coefficient of determination	.97
F - Manufacturing jobs	178.73
F - House prices	2.00
F - Final equation	173.20
Durbin-Watson statistic	2.29

TABLE 27

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
FINANCIAL JOBS, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Bank deposits.....	-.02	-.12	.98	.15
Houses sold.....	-.57	-.53	.03	3.81
Housing starts.....	.01	.04	.66	.02
Retail sales.....	.02	.04	.10	.02
Per capita income..	.10	.14	.06	.20

house prices (2.00). Significant autocorrelation is not present, as shown by the value of the Durbin-Watson statistic. Of the remaining independent variables shown in table 27, only the number of houses sold shows a potential significant contribution to explaining the relationship (F=3.81). However, the tolerance level of .03 shows that significant multicollinearity exists with the independent variables already in the equation: manufacturing jobs, and house prices.

Retail Jobs

The number of persons employed by retail establishments in Wichita Falls for the study period is shown in table 28.

Multiple regression was performed for the data shown in table 28 as the dependent variable, and the data shown in table 18 as the independent variables. The Durbin-Watson statistic was found to be .80, indicating significant autocorrelation. To compensate for the presence of autocorrelation, first differences rather than actual data were used.

The results of step one for the multiple regression are summarized in table 29. The number of housing starts was found to be highly correlated with the number of persons employed in retail jobs. The absence of values less than .20 in the tolerance column in table 30 indicates that by using first differences rather than actual data, the possibility of multicollinearity is reduced.

TABLE 28

PERSONS EMPLOYED IN RETAIL ESTABLISHMENTS IN WICHITA FALLS, TEXAS, 1962-1977

Year	Number
1962	7,378
1963	7,490
1964	7,262
1965	7,349
1966	7,832
1967	7,962
1968	8,398
1969	8,656
1970	9,020
1971	9,240
1972	9,690
1973	10,100
1974	10,690
1975	11,250
1976	11,750
1977	12,180

Source: Texas Employment Commission, Manpower Trends--Wichita Falls, Texas, 18 volumes. (Wichita Falls, Texas, 1962-1977), passim.

TABLE 29

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--RETAIL JOBS, INDEPENDENT VARIABLE--HOUSING STARTS

Statistic	Value
Coefficient of correlation	.74
Coefficient of determination	.55
Adjusted coefficient of determination	.51
Standardized regression coefficient	.74
F	13.27

TABLE 30

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--RETAIL JOBS, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Manufacturing jobs..	-.01	-.01	.81	.00
Bank deposits.....	.00	-.01	.98	.00
Houses sold.....	.25	.35	.90	1.36
House prices.....	.29	.43	.99	2.25
Retail sales.....	.17	.26	.99	.71
Per capita income...	-.28	-.41	.99	2.04

Steps two, three, and four introduced into the regression equation, the following three variables: (1) house prices, (2) houses sold, (3) per capita income. Summaries of the calculations for the final step are shown in tables

31 and 32. Table 33 shows a summary of the vital statistics and changes in their values during the calculations.

Public Sector Activity

To determine the relationship between industrialization, those areas of the private sector influenced by manufacturing activity, and the public sector, two areas were examined; municipal government expenditures, and public school expenditures. These values, as in previous calculations, were adjusted for inflation by dividing yearly values by the consumer price index. Previous studies have frequently cited increased revenue and a broadened tax base as benefits of industrialization. However, frequently overlooked is the fact that public expenditures usually increase as revenue increases, and as cited in chapter 2, may more than offset increases in revenue. In the case of Wichita Falls, it was found that both in municipal government and the public school system, for all practical purposes, costs were equal to revenue.

Property Tax Valuations and Rates

The primary source of income for local municipalities has historically been through property taxes. A number of case studies have shown that as communities experienced growth in manufacturing, the demand for increased public services has often resulted in an increase in property tax rates, property valuations, or in some cases, both. Municipal

TABLE 31

STEP 4--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
RETAIL JOBS, INDEPENDENT VARIABLES--
HOUSING STARTS, HOUSE PRICES, HOUSES
SOLD, AND PER CAPITA INCOME

Statistic	Value
Coefficient of correlation	.85
Coefficient of determination	.72
Adjusted coefficient of determination	.62
F - Housing starts	11.32
F - House prices	2.00
F - Houses sold	3.44
F - Per capita income	1.63
F - Final equation	6.50
Durbin-Watson test	2.71

TABLE 32

STEP 4--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
RETAIL SALES, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Manufacturing jobs..	-.06	-.09	.49	.05
Bank deposits.....	.05	.10	.82	.07
Retail sales.....	.03	.06	.85	.02

TABLE 33

MULTIPLE REGRESSION SUMMARY TABLE
INDEPENDENT VARIABLE--
RETAIL JOBS

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Housing starts.....	.74	.55	.55	.74
House prices.....	.79	.63	.08	.35
Houses sold.....	.85	.72	.09	.48
Per capita income..	.87	.76	.05	-.26

and county property valuations, both adjusted for inflation and unadjusted, are shown in table 34.

The data presented in table 34 show that while it appears that property valuations for tax purposes have been increasing, after adjusting for inflation, county and municipal property values have in fact declined, with a few notable examples (1963-1965, 1972, and 1976-1977). This is not intended to lead one to conclude that actual market values have declined, for, as noted previously, the prices of houses sold (after adjusting for inflation) have in fact increased. These figures, coupled with the data presented in table 35, show that the local tax base, after adjusting for inflation, has decreased. However, the role of the state and federal governments (in the form of revenue sharing) in providing funds for the local government and school system has been expanding. This is shown by the data presented in table 36.

Municipal Expenditures

Yearly city government expenditures for the study period are shown in table 37.

Using inflation adjusted municipal expenditures as the dependent variable, the following variables were employed in multiple regression as independent variables:

1. Number of persons employed in manufacturing
2. Number of persons employed in retail trade
3. Number of persons employed in construction

TABLE 34

MUNICIPAL AND COUNTY PROPERTY VALUATIONS
FOR WICHITA FALLS, TEXAS
1962-1977

Year	Municipal Valuation (millions of dollars)	County Valuation (millions of dollars)	Adjusted for Inflation	
			Municipal Valuation (millions of dollars)	County Valuation (millions of dollars)
1962...	440,000.0	295,297.0	485,651.2	325,934.9
1963...	466.000.0	309,078.8	508,178.8	337,054.3
1964...	476.000.0	318,131.8	512,378.9	342,445.4
1965...	488,000.0	326,326.6	516,402.1	345,319.2
1966...	488,000.0	333,928.2	502,057.6	343,547.5
1967...	492,000.0	340,826.0	492,000.0	340,826.0
1968...	496,000.0	347,483.2	476,007.7	333,477.2
1969...	484,187.0	357,615.2	440,971.6	325,696.9
1970...	494,000.0	366,900.4	424,763.5	315,477.6
1971...	508,000.0	380,500.0	418,796.4	3B,685.1
1972...	526,000.0	396,485.8	419,792.5	316,429.2
1973...	547,000.0	415,264.0	410,969.2	311,994.0
1974...	578,000.0	445,262.2	391,333.8	301,463.9
1975...	617,857.1	487.692.2	383,286.1	302,538.6
1976...	671,428.6	552,378.2	393,799.8	323,975.5
1977...	815,000.0	658,949.8	448,788.5	362,857.8

Sources: City of Wichita Falls, Annual Budget and Work Program 1962-1977. (Wichita Falls, Texas. City of Wichita Falls.) and Wichita County Tax Assessor and Collectors Office, Wichita County, correspondence of 20 March 1978. (Typewritten).

TABLE 35

CITY AND COUNTY TAX RATES PER ONE HUNDRED DOLLAR VALUATION, WICHITA FALLS, TEXAS 1962-1977

Year	City Tax Rate*	School Tax Rate*	County Tax Rate
1962	1.47	1.40	1.05
1963	1.47	1.50	1.05
1964	1.60	1.50	1.05
1965	1.70	1.61	1.05
1966	1.81	1.61	1.05
1967	1.81	1.61	1.05
1968	1.78	1.78	1.05
1969	1.92	1.86	1.05
1970	1.92	1.86	1.05
1971	1.90	1.86	1.05
1972	1.88	1.86	1.05
1973	1.82	1.92	1.05
1974	1.30	1.50	1.00
1975	1.22	1.50	.97
1976	1.05	1.40	.97
1977	1.01	1.17	.97

Sources: City of Wichita Falls, Annual Budget and Work Program 1962-1977. (Wichita Falls, Texas. City of Wichita Falls.); and Wichita County Tax Assessor and Collectors Office, Wichita County, correspondence of 20 March 1978. (Typewritten).

* Starting in 1974 tax rates based on seventy percent valuation rather than fifty percent as in prior years.

TABLE 36

REVENUE SOURCES FOR WICHITA FALLS
INDEPENDENT SCHOOL DISTRICT
1962-1977

Year	Local	State	Federal	Adjusted for Inflation Local	Adjusted for Inflation State	Adjusted for Inflation Federal
1962...	2,898,721	3,283,921	7,933	3,199,471	3,624,637	8,756
1963...	3,220,935	3,276,550	6,895	3,512,470	3,573,118	7,519
1964...	3,722,962	3,572,883	264,696	4,007,494	3,845,945	284,925
1965...	3,827,416	3,569,519	396,596	4,050,175	3,777,268	419,678
1966...	4,011,169	4,381,614	397,688	4,126,717	4,507,833	409,144
1967...	4,063,846	4,289,189	507,108	4,063,846	4,289,189	507,108
1968...	4,048,772	4,786,032	682,482	3,885.577	4,593,120	654,973
1969...	4,513,158	4,487,670	619,589	4,110,344	4,087,131	564,973
1970...	4,947,732	5,386,869	667,313	4,254,283	4,631,873	573,785
1971...	5,139,796	6,627,441	625,680	4,237,259	5,463,677	515,812
1972...	5,271,493	6,675,722	779,231	4,207,097	5,327,790	543,103
1973...	5,430,129	6,499,035	560,594	5,079,736	4,882,821	421,182
1974...	5,933,239	7,112,303	757,988	4,017,088	4,815,371	513,194
1975...	6,804,737	7,889,924	522,157	4,221,300	4,894,493	342,529
1976...	7,462,340	10,130,386	622,594	4,376,739	5,941,575	365,157
1977...	8,497,284	9,818,685	842,881	4,679,121	5,406,764	464,141

Source: Wichita Falls Public School System, Wichita Falls, Texas, correspondence of 27 May 1978.

TABLE 37

YEARLY MUNICIPAL GOVERNMENT EXPENDITURES
WICHITA FALLS, TEXAS 1962-1977

Year	Expenditures (dollars)	Adjusted for Inflation Expenditures (dollars)
1962	6,191,865	6,834,288
1963	6,607,360	7,205,408
1964	7,374,679	7,938,298
1965	7,963,151	8,426,615
1966	8,799,739	9,053,229
1967	9,388,995	9,388,995
1968	9,711,244	9,319,812
1969	10,733,737	9,775,717
1970	11,574,228	9,952,045
1971	12,094,192	9,970,480
1972	12,766,370	10,188,643
1973	13,246,002	9,951,917
1974	14,134,200	9,569,533
1975	15,951,312	9,895,355
1976	17,011,475	9,977,405
1977	18,301,687	10,078,021

Source: City of Wichita Falls, Annual Budget and Work Program 1962-1977. (Wichita Falls, Texas, City of Wichita Falls.)

4. Number of persons employed in financial jobs (banking, real estate, insurance)
5. Inflation-adjusted city bank deposits
6. Number of houses sold
7. Inflation-adjusted mean sales price of houses
8. Number of new houses started
9. Inflation-adjusted retail sales in the city
10. Inflation-adjusted per capita income

The results of regression calculations are shown in tables 38, 39, and 40.

As can be seen from the data presented in table 40, the four independent variables (retail jobs, construction jobs, housing starts, and house prices), working together, explain 81 percent (72 after adjusted for the number of degrees of freedom) of the variance in the municipal expenditures during the time period. The F value in the final equation of 9.44 indicates that the relationship is significant at a level of .01. The Durbin-Watson statistic (1.71) suggests that significant autocorrelation is not present in the residuals. Table 39 presents statistics for independent variables which did not enter the regression calculations. Of the remaining independent variables, only the number of houses sold (F = 5.1) represents a potential contribution to the equation. However, the low tolerance value (.03) suggests high correlation with variables already in the equation, and thus would distort the values

TABLE 38

STEP 4--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
MUNICIPAL EXPENDITURES, INDEPENDENT VARIABLES--
RETAIL JOBS, CONSTRUCTION JOBS,
HOUSING STARTS, HOUSE PRICES

Statistic	V alue
Coefficient of correlation	.90
Coefficient of determination	.81
Adjusted coefficient of determination	.72
F - Retail jobs	18.56
F - Construction jobs	8.38
F - Housing starts	8.18
F - House prices	3.88
F - Final equation	9.44
Durbin-Watson test	1.71

TABLE 39

STEP 4--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
MUNICIPAL EXPENDITURES, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Financial jobs.....	.77	.34	.04	1.06
Manufacturing jobs..	-.23	-.08	.02	.05
Bank deposits.....	-.15	-.29	.72	.75
Houses sold.....	-1.46	-.62	.03	5.01
Retail sales.....	-.53	-.37	.09	1.29
Per capita income...	.63	.33	.05	.95

TABLE 40

MULTIPLE REGRESSION SUMMARY TABLE
INDEPENDENT VARIABLE--MUNICIPAL
EXPENDITURES

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Retail jobs.....	.71	.51	.51	.71
Construction jobs..	.77	.59	.08	.40
Housing starts.....	.85	.72	.13	.19
House prices.....	.90	.81	.08	.62

if it were allowed to enter the equation. As can be seen from the statistic labeled coefficient of correlation, these four variables are positively correlated with municipal expenditures. That is, as the values of each of these variables increase, municipal government expenditures also increase.

Simple coefficients of correlation for all of the independent variables listed on pages 81 and 86 and municipal government expenditures are shown in table 41. As can be seen from the data presented in the table, positive correlations exist for all of the variables except one (bank deposits).

TABLE 41

SIMPLE COEFFICIENTS OF CORRELATION
INDEPENDENT VARIABLE--MUNICIPAL
GOVERNMENT EXPENDITURES

Variable	Coefficient of Correlation
Retail jobs	.71
Construction jobs	.40
Financial jobs	.70
Manufacturing jobs	.63
Bank deposits	-.04
Houses sold	.56
House prices	.62
Housing starts	.19
Retail sales	.67
Per capita income	.69

Public School System Expenditures

Total expenditures for the Wichita Falls Independent School District for each of the years studied are presented in table 42.

TABLE 42

SCHOOL DISTRICT EXPENDITURES FOR WICHITA FALLS, TEXAS 1962-1977

Year	Expenditures (dollars)	Adjusted for Inflation Expenditures (dollars)
1962	5,769,336	6,367,921
1963	6,316,275	6,887,977
1964	6,669,667	7,179,405
1965	6,740,307	7,132,600
1966	7,743,233	7,966,289
1967	7,937,855	7,937,855
1968	8,526,516	8,182,837
1969	8,912,297	8,116,846
1970	10,054,313	8,645,153
1971	10,491,272	8,649,029
1972	11,002,915	8,781,257
1973	11,098,877	8,338,751
1974	11,779,063	7,974,992
1975	13,324,025	8,265,524
1976	15,920,324	9,337,433
1977	16,936,345	9,326,181

Source: Wichita Falls Public School System, Wichita Falls, Texas, correspondence of 27 May 1978.

Multiple regression was used to determine the relationship between those independent variables listed in table 43 and the inflation-adjusted public school expenditures. The results of these calculations are shown in tables 44, 45, and 46.

TABLE 43

SIMPLE COEFFICIENTS OF CORRELATION
INDEPENDENT VARIABLE--PUBLIC
SCHOOL SYSTEM EXPENDITURES

Variable	Coefficient of Correlation
Retail jobs	.75
Construction jobs	.46
Financial jobs	.74
Manufacturing jobs	.65
Bank deposits	-.07
Houses sold	.58
House prices	.72
Housing starts	.47
Retail sales	.64
Per capita income	.69

TABLE 44

STEP 3--MULTIPLE REGRESSION: DEPENDENT VARIABLE--PUBLIC SCHOOL EXPENDITURES, INDEPENDENT VARIABLES--RETAIL JOBS, HOUSE PRICES, CONSTRUCTION JOBS

Statistic	Value
Coefficient of correlation	.84
Coefficient of determination	.71
Adjusted coefficient of determination	.62
F - Retail jobs	6.31
F - House prices	2.93
F - Construction jobs	2.30
F - Final equation	8.00
Durbin-Watson test	1.66

TABLE 45

STEP 3--MULTIPLE REGRESSION: DEPENDENT VARIABLE--PUBLIC SCHOOL EXPENDITURES, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Financial jobs.....	.48	.18	.04	.28
Manufacturing jobs..	-1.56	-.45	.02	2.31
Bank deposits.....	- .04	-.07	.82	.04
Houses sold.....	-2.17	-.78	.04	14.38
Housing starts.....	- .11	-.16	.58	.23
Retail sales.....	- .91	-.53	.10	3.49
Per capita income...	.45	.19	.05	.34

TABLE 46

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--PUBLIC
SCHOOL EXPENDITURES

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Retail jobs.....	.75	.56	.56	.75
House prices.....	.80	.64	.08	.72
Construction jobs..	.84	.71	.07	.46

The value of the Durbin-Watson statistic (1.66) indicates an absence of significant autocorrelation in the residuals. The F value in the final equation (8.00) shows that the relationship between the three independent variables (retail jobs, house prices, construction jobs), working together, have a significant linear relationship (at a level of .01) with the expenditures by the Wichita Falls public school system. Table 45 shows that the number of persons employed in manufacturing jobs, the number of houses sold, and retail sales offer further contribution to the final equation; however, the low tolerance values associated with each of these variables indicate significant multicollinearity with independent variables in the equation. The values under the simple coefficient of correlation show that each of the independent variables in the equation is positively correlated with public school expenditures.

Quality of Living

A sub-objective of this study was to determine if there existed a relationship between industrialization and variables used to measure the quality of life in Wichita Falls. As discussed previously, a strong positive linear relationship was found between industrialization and other sectors of the local private economy. This further led to a relationship between the affected local private economy and expenditures by both the municipal government and the

public school system. Of interest is the question of whether or not the positive changes in the private and public economies are followed by changes in the quality of life in the community experiencing industrialization.

Per-Capita Income

Of the variables used to measure quality of life, not only for local communities but for states in the United States and different countries of the world, per-capita income is frequently used. As presiously discussed, a strong positive bivariate relationship exists between per-capita income (adjusted for inflation) and the number of persons employed by manufacturing companies. In order to further examine the relationship between per-capita income and the phenomenon of industrialization, multiple regression calculations were performed using per-capita income (adjusted for inflation), as the dependent variable, and those variables shown in table 47, as independent variables. Consistent with other parts of the study, multicollinearity was compensated for by using a low tolerance level (.20) for exclusion of independent variables not in the equation. Furthermore, only independent variables which represent a potential contribution to explaining the relationship (those with an F of greater than 1.5) were allowed to enter the calculations. Table 47 shows the coefficients of correlation for the listed independent variables and per capita income.

TABLE 47

SIMPLE COEFFICIENTS OF CORRELATION
INDEPENDENT VARIABLE--PER
CAPITA INCOME

Variable	Coefficient of Correlation
Retail jobs	.96
Construction jobs	.83
Financial jobs	.95
Manufacturing jobs	.97
Bank deposits	.16
Houses sold	.95
House prices	.60
Housing starts	.48
Retail sales	.93

As can be seen from the data presented in table 47, all of the independent variables, with the exception of bank deposits, have a fairly high correlation coefficient with per-capita income. The most significant relationship was found to exist between per-capita income and the number of persons employed in manufacturing jobs. Thus, this was the first independent variable to enter multiple regression calculations. The results of these calculations are shown in tables 48, 49, and 50.

TABLE 48

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--PER CAPITA INCOME, INDEPENDENT VARIABLES--MANUFACTURING JOBS, BANK DEPOSITS

Statistic	Value
Coefficient of correlation	.97
Coefficient of determination	.95
Adjusted coefficient of determination	.94
F - Manufacturing jobs	203.38
F - Bank deposits	3.25
F - Final equation	104.44
Durbin-Watson test	1.34

TABLE 49

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
PER CAPITA INCOME, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Retail jobs.....	.33	.31	.04	1.06
Construction jobs..	-.15	-.29	.19	.93
Financial jobs.....	.17	.15	.04	.23
Houses sold.....	-.76	-.44	.02	2.36
House prices.....	-.04	-.15	.58	.22
Housing starts.....	-.02	-.07	.61	.04
Retail sales.....	.09	.13	.10	.18

TABLE 50

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--
PER CAPITA INCOME

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Manufacturing jobs..	.97	.94	.94	.97
Bank deposits.....	.97	.95	.01	.16

The F value in the final equation indicates that the number of manufacturing jobs and the amount of bank deposits (adjusted for inflation) have a significant linear relationship with per-capita income. As seen from the data presented in table 47, a majority of the independent variables have correlation coefficients which are greater than .50, and five of the nine are greater than .90. However, when manufacturing jobs enter the equation, these must be discounted, due to the high degree of colinearity between manufacturing jobs and these other independent variables. This can also be seen by the low tolerance values in table 49. The F value for bank deposits in table 48 shows that bank deposits do not contribute significantly when manufacturing jobs are controlled. However, working together, these two independent variables have a significant relationship with per-capita income. As shown by the data presented in table 50, the simple coefficients of correlation are both positive, indicating that as the values of these two variables increase, per-capita income increases.

Public School Expenditures Per Student

As discussed previously, Wichita Falls public school expenditures, after adjusting for inflation, have increased during the study period. Furthermore, a significant relationship was found between school expenditures and three independent variables (retail jobs, house prices,

and construction jobs), which had significant relationships with the number of persons employed by manufacturing companies. To further examine the question of public school expenditures, expenditures (adjusted for inflation) per student were tested as a measure of the quality of education in the public school system. Presented in table 51 are public school expenditures, average daily attendance, and per-capita expenditures (both unadjusted and adjusted for inflation). Regression calculations used expenditures adjusted for inflation in order to provide constant dollar values, consistent with other sections of the study.

Correlations coefficients are shown in table 52. The results of multiple regression calculations are shown in tables 53, 54, and 55.

As can be seen from the data presented in table 52, a fairly high correlation coefficient exists for almost all of the independent variables. In the final analysis, the variance in the number of persons employed by retail establishments and housing prices explain over ninety-two percent of the variance in per-student public school expenditures. The presence of multicollinearity prevents the introduction of other independent variables into the equation. The relationship is positive as shown by the positive signs of the simple coefficients of correlation in table 55.

TABLE 51

WICHITA FALLS INDEPENDENT SCHOOL DISTRICT EXPENDITURES 1962-1977

Year	Expenditures (dollars)	Average Daily Attendance	Per Capita Expenditures (dollars)	Per Capita Expenditures Adjusted for Inflation (dollars)
1962...	5,769,336	17,048	338.42	373.53
1963...	6,316,275	17,705	356.75	389.04
1964...	6,669,667	17,860	373.44	401.98
1965...	6,740,307	17,530	384.50	406.88
1966...	7,743,233	16,986	455.86	468.99
1967...	7,937,855	17,434	455.31	455.31
1968...	8,526,516	17,309	492.61	472.75
1969...	8,912,297	17,070	522.10	475.50
1970...	10,054,313	16,996	591.57	508.66
1971...	10,491,272	16,397	639.82	527.48
1972...	11,002,915	15,621	704.37	562.15
1973...	11,098,877	15,281	726.32	545.69
1974...	11,779,063	14,840	793.74	537.40
1975...	13,324,025	14,652	909.37	564.13
1976...	15,920,324	14,412	1,104.66	647.89
1977...	16,936,345	14,174	1,194.89	657.98

Source: Wichita Falls Public School System, Wichita Falls, Texas, correspondence of 27 May 1978.

TABLE 52

SIMPLE COEFFICIENTS OF CORRELATION--
DEPENDENT VARIABLE PER STUDENT
PUBLIC SCHOOL EXPENDITURES

Variable	Coefficient of Correlation
Retail jobs	.94
Construction jobs	.73
Financial jobs	.94
Manufacturing jobs	.89
Bank deposits	-.06
Houses sold	.86
House prices	.79
Housing starts	.56
Retail sales	.87
Per capita income	.90

TABLE 53

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--PER STUDENT PUBLIC SCHOOL EXPENDITURE, INDEPENDENT VARIABLES--RETAIL JOBS, HOUSE PRICES

Statistic	Value
Coefficient of correlation	.96
Coefficient of determination	.93
Adjusted coefficient of determination	.91
F - Retail jobs	45.18
F - House prices	5.53
F - Final equation	70.32
Durbin-Watson test	1.46

TABLE 54

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--PER STUDENT PUBLIC SCHOOL EXPENDITURE, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Construction jobs...	-.11	-.24	.35	.60
Financial jobs.....	.24	.18	.04	.35
Manufacturing jobs..	-.50	-.37	.04	1.61
Bank deposits.....	-.02	-.08	.99	.06
Houses sold.....	-.62	-.58	.06	4.97
Housing starts.....	-.00	-.01	.65	.00
Retail sales.....	-.29	-.34	.10	1.31
Per capita income...	.16	.15	.06	.24

TABLE 55

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--PER STUDENT
PUBLIC SCHOOL EXPENDITURE

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Retail jobs.....	.94	.89	.89	.94
House prices.....	.96	.93	.04	.79

Unemployment

A variable that is almost universally used to test the economic health of a community, state, or nation is the unemployment rate. In order to test the relationship between industrialization and unemployment, rates of unemployment for the study period were used as dependent variables, and the variables listed in table 57 were used as independent variables. Unemployment rates for those years studied are shown in table 56.

As can be seen from the data presented in table 57, all but two of the coefficients have positive signs, suggesting that as the values of each of these variables increases, unemployment rates increase. However, the values are substantially lower than those previously discussed in this section, suggesting that the relationship is not as strong. Unemployment rates have tended to be higher following the year of 1969, which might be considered the first rapid year of manufacturing growth. The mean unemployment rate for the years 1962-1969 was 3.39, while the mean unemployment rate was 3.625. The difference is not statistically significant.

Results of the regression calculations are shown in tables 58, 59 and 60.

TABLE 56

UNEMPLOYMENT RATES FOR WICHITA FALLS TEXAS 1962-1977

Year	Unemployment Rate
1962	4.7
1963	4.6
1964	4.0
1965	3.5
1966	3.0
1967	2.8
1968	2.2
1969	2.3
1970	3.1
1971	3.3
1972	3.2
1973	2.7
1974	3.4
1975	4.6
1976	4.7
1977	4.0

Source: Texas Employment Commission, Manpower Trends--Wichita Falls, Texas, 16 volumes. (Wichita Falls, Texas, 1962-1977), passim.

TABLE 57

SIMPLE COEFFICIENTS OF CORRELATION--
DEPENDENT VARIABLE--UNEMPLOYMENT
RATES

Variable	Coefficient of Correlation
Retail jobs	.29
Construction jobs	.35
Financial jobs	.31
Manufacturing jobs	.38
Bank deposits	-.02
Houses sold	.44
House prices	-.04
Housing starts	.56
Retail sales	.27
Per capita income	.29

TABLE 58

STEP 3--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
UNEMPLOYMENT RATES, INDEPENDENT VARIABLES--
HOUSING STARTS, HOUSE PRICES,
CONSTRUCTION JOBS

Statistic	Value
Coefficient of correlation	.83
Coefficient of determination	.68
Adjusted coefficient of determination	.60
F - Housing starts	14.57
F - House prices	10.47
F - Construction jobs	6.92
F - Final equation	7.22
Durbin-Watson test	1.37

TABLE 59

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
UNEMPLOYMENT RATES, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Retail jobs.....	-.34	-.29	.22	.80
Financial jobs.....	-.28	-.23	.21	.50
Manufacturing jobs..	-.24	-.18	.17	.29
Bank deposits.....	.18	.28	.74	.78
Houses sold.....	.01	.01	.16	.00
Retail sales.....	-.05	-.06	.33	.03
Per capita income...	-.39	-.34	.25	1.20

TABLE 60

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE
UNEMPLOYMENT RATE

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Housing starts.....	.56	.32	.32	.56
House prices.....	.68	.47	.15	-.04
Construction jobs..	.83	.68	.22	.35

As the data in table 58 indicate, the three independent variables which best explained the variance in the unemployment rate all dealt with construction, which is generally considered to be a seasonal industry. The F value in the final equation (7.22) indicates a significant linear relationship at a level of significance of .01.

Infant Mortality

The number of infant deaths at birth is a frequently cited indicator of the quality of life. It was felt that as job opportunities, income, and quality of education increase, a lower infant mortality rate may result. Infant mortality rates for each of the years studied are shown in table 61. Using the rates as the dependent variable, multiple regression calculations were performed, with the variables listed in table 62 used as independent variables. The results of these calculations are shown in tables 63, 64 and 65.

The data presented in table 62 indicate that the correlation coefficient for each of the independent variables has a negative sign. This means that as the values for each of these variables increases, infant mortality rates decrease. However, the F values in table 63 do not indicate a significant relationship. That is the relationship could possibly have occurred by chance; thus it is concluded that there is no significant relationship between

TABLE 61

INFANT MORTALITY RATES FOR
WICHITA FALLS, TEXAS
1962-1977

Year	Infant Mortality Rate (Number per 1,000 births)
1962	51
1963	48
1964	48
1965	45
1966	27
1967	41
1968	24
1969	34
1970	37
1971	45
1972	56
1973	37
1974	35
1975	28
1976	21
1977	NA

Source: Texas Department of Vital Statistics, Texas Vital Statistics, 16 volumes. (Austin, 1962-1976), passim.

TABLE 62

SIMPLE COEFFICIENTS OF CORRELATION--
DEPENDENT VARIABLE--INFANT
MORTALITY RATE

Variable	Coefficient of Correlation
Retail jobs	-.44
Construction jobs	-.34
Financial jobs	-.35
Manufacturing jobs	-.33
Bank deposits	-.48
Houses sold	-.36
House prices	-.44
Housing starts	-.09
Retail sales	-.39
Per capita income	-.42

TABLE 63

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--INFANT MORTALITY RATES, INDEPENDENT VARIABLES--BANK DEPOSITS, RETAIL JOBS

Statistic	Value
Coefficient of correlation	.63
Coefficient of determination	.39
Adjusted coefficient of determination	.28
F - Bank deposits	3.65
F - Retail jobs	3.02
F - Final equation	3.56
Durbin-Watson test	1.96

TABLE 64

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--INFANT MORTALITY RATES, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Construction jobs...	.41	.29	.29	.89
Financial jobs.....	1.45	.37	.04	1.61
Manufacturing jobs..	2.00	.53	.04	3.91
Houses sold.....	1.66	.52	.06	3.71
House prices.....	-.19	-.18	.51	.32
Housing starts.....	.02	.02	.57	.30
Retail sales.....	.42	.17	.10	.30
Per capita income...	.73	.25	.06	.67

TABLE 65

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--INFANT
MORTALITY RATE

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Bank deposits.....	.48	.28	.28	-.48
Retail jobs.....	.63	.39	.17	-.44

the infant mortality rate and factors influenced by industrialization.

Crime Rate

In reviewing the literature it was found that it was not uncommon for a community to experience an increase in the crime rate following industrialization. The interpretation of a change in the crime rate is subject to debate, as discussed in chapter v. In order to test the relationship between the crime rate and industrialization, multiple regression calculations were performed with the crime rate for Wichita Falls for the years studied (shown in table 66) as the dependent variable and those variables shown in table 67 as the independent variables.

As can be seen from the data presented in table 66 the Wichita Falls crime rate has been on the rise. The rise has been more rapid since 1972. The correlation coefficients shown in table 67 indicate that each of these independent variables is positively correlated with the crime rate, supporting the hypothesis that industrialization might lead to increased crime. These independent variables are highly intercorrelated, thus restricting the introduction of some variables due to the problems of multicollinearity. The two variables that are introduced into the multiple regression calculation (houses sold, bank deposits) were found to be significantly related to

TABLE 66

CRIME RATES FOR WICHITA FALLS, TEXAS 1962-1977

Year	Crime Rate (number per 100,000 population)
1962	1,006.4
1963	1,304.3
1964	1,357.0
1965	1,496.0
1966	1,163.4
1967	1,326.3
1968	1,531.7
1969	1,389.0
1970	1,549.9
1971	1,627.7
1972	1,760.2
1973	3,661.2
1974	4,618.4
1975	5,073.0
1976	5,823.5
1977	NA

Source: Federal Bureau of Investigation, Crime in the U.S.--F.B.I. Uniform Crime Report, 15 volumes, (Washington D. C. 1962-1977), passim.

TABLE 67

SIMPLE COEFFICIENTS OF CORRELATION
DEPENDENT VARIABLE--CRIME RATE

Variable	Coefficient of Correlation
Retail jobs	.91
Construction jobs	.88
Financial jobs	.89
Manufacturing jobs	.93
Bank deposits	.28
Houses sold	.96
House prices	.57
Housing starts	.51
Retail sales	.89
Per capita income	.92

TABLE 68

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--CRIME RATE, INDEPENDENT VARIABLES--HOUSES SOLD, BANK DEPOSITS

Statistic	Value
Coefficient of correlation	.97
Coefficient of determination	.94
Adjusted coefficient of determination	.93
F - Houses sold	169.90
F - Bank deposits	4.45
F - Final equation	92.60
Durbin-Watson test	1.47

TABLE 69

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--CRIME RATE, INDEPENDENT VARIABLES NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Retail jobs.....	-.18	-.19	.06	.38
Construction jobs...	.10	.20	.22	.41
Financial jobs.....	-.16	-.19	.08	.37
Manufacturing jobs..	-.06	-.03	.02	.01
House prices.....	-.05	-.18	.60	.33
Housing starts.....	.08	.25	.57	.64
Retail sales.....	-.16	-.21	.10	.45
Per capita income...	.00	.00	.09	.00

TABLE 70

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--
CRIME RATE

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Houses sold.....	.96	.92	.92	.96
Bank deposits....	.97	.94	.02	.28

the crime rate, as evidenced by the F value in the final equation (92.60).

Traffic Deaths

The number of traffic deaths is a frequently cited indicator of the quality of life in communities. The number of traffic deaths for each of the years studied is shown in table 71. Correlation coefficients for each of the independent variables used in the multiple regression calculations is shown in table 72. Results of the calculations are shown in tables 73, 74 and 75.

The F value in the final equation in table 73 (7.93) indicates that, working together, the numbers of persons employed in construction jobs and retail sales are significantly related to the number of traffic deaths occurring in the city. However, the impact is less clear than in previous cases, since traffic deaths are negatively correlated with construction jobs and positively correlated with retail sales.

Police and Fire Protection

As a final test of the relationship between quality of life and industrialization, a dependent variable was chosen for multiple regression calculations to represent police and fire protection. The total number of policemen and firemen employed each year was divided by yearly population estimates for a per-capita police and fire

TABLE 71

TRAFFIC DEATHS IN WICHITA FALLS, TEXAS 1962-1977

Year	Number of Deaths
1962	NA
1963	NA
1964	12
1965	13
1966	12
1967	18
1968	17
1969	15
1970	19
1971	14
1972	14
1973	17
1974	12
1975	18
1976	15
1977	16

Source: Texas Department of Vital Statistics, Vital Statistics, 15 volumes. (Austin, 1962-1977), passim.

TABLE 72

SIMPLE COEFFICIENTS OF CORRELATION
DEPENDENT VARIABLE--TRAFFIC DEATHS

Variable	Coefficient of Correlation
Retail jobs	-.01
Construction jobs	-.44
Financial jobs	-.03
Manufacturing jobs	-.12
Bank deposits	-.17
Houses sold	-.13
House prices	.09
Housing starts	.28
Retail sales	.10
Per capita income	-.05

TABLE 73

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
TRAFFIC DEATHS, INDEPENDENT VARIABLES--
CONSTRUCTION JOBS, RETAIL SALES

Statistic	Value
Coefficient of correlation	.77
Coefficient of determination	.59
Adjusted coefficient of determination	.52
F - Construction jobs	15.58
F - Retail sales	10.70
F - Final equation	7.93
Durbin-Watson test	2.31

TABLE 72

STEP 2--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
TRAFFIC DEATHS, INDEPENDENT VARIABLES
NOT IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Retail jobs.....	.14	.06	.08	.04
Financial jobs.....	.18	.08	.08	.07
Manufacturing jobs..	-.71	-.24	.05	.63
Bank deposits.....	.08	.11	.88	.12
Houses sold.....	-1.11	-.33	.04	1.20
House prices.....	.22	.25	.52	.67
Housing starts.....	.21	.28	.73	.86
Per capita income...	.29	.13	.08	.18

TABLE 75

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--
TRAFFIC DEATHS

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Construction jobs..	.44	.19	.19	-.44
Retail sales.....	.77	.59	.40	.10

protection variable. The number of policemen and firemen for each year studied, as well as the per-capita values, are shown in table 76. Coefficients of correlation for per capita police and fire protection and each of the independent variables for which multiple regression calculations were performed are shown in table 77. Results of regression calculations are shown in tables 78, 79 and 80.

As can be seen from the data presented in table 78, high positive-correlation coefficients were found for practically all of the independent variables. The highest correlation exists with the number of persons employed in financial jobs. The presence of a high degree of multicollinearity prevented the introduction of other independent variables into the equation. The F value (218.29) indicates a significant relationship between per-capita policemen and firemen and the number of persons employed in financial jobs.

TABLE 76

NUMBER OF POLICEMEN AND FIREMEN AND
PER CAPITA POLICE/FIRE
WICHITA FALLS, TEXAS
1962-1977

Year	Number of Police	Number of Fire	Per capita Police and Fire
1962	102	118	2.07
1963	113	115	2.11
1964	115	127	2.21
1965	116	132	2.25
1966	116	132	2.30
1967	114	132	2.27
1968	116	132	2.24
1969	117	132	2.22
1970	119	131	2.49
1971	119	131	2.49
1972	117	131	2.46
1973	119	130	2.61
1974	124	130	2.62
1975	124	129	2.62
1976	130	139	2.74
1977	130	139	NA

Source: City of Wichita Falls, Annual Budget and Work Program. (Wichita Falls, Texas. City of Wichita Falls, 1962-1977), passim.

TABLE 77

SIMPLE COEFFICIENTS OF CORRELATION
INDEPENDENT VARIABLE--PER CAPITA
POLICEMEN AND FIREMEN

Variable	Coefficient of Correlation
Retail jobs	.93
Construction jobs	.82
Financial jobs	.97
Manufacturing jobs	.95
Bank deposits	-.01
Houses sold	.90
House prices	.70
Housing starts	.50
Retail sales	.89
Per capita income	.92

TABLE 78

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
PER CAPITA POLICEMEN AND FIREMEN
INDEPENDENT VARIABLE--
FINANCIAL JOBS

Statistic	Value
Coefficient of correlation	.97
Coefficient of determination	.95
Adjusted coefficient of determination	.94
F - Financial jobs	218.29
F - Final equation	218.29
Durbin-Watson test	1.20

TABLE 79

STEP 1--MULTIPLE REGRESSION: DEPENDENT VARIABLE--
PER CAPITA POLICEMEN AND FIREMEN,
INDEPENDENT VARIABLES--NOT
IN THE EQUATION

Variable	Beta In	Partial	Tolerance	F
Retail jobs.....	-.52	-.46	.04	3.00
Construction jobs...	.07	.17	.33	.31
Manufacturing jobs..	-.24	-.20	.04	.45
Bank deposits.....	-.04	-.16	.99	.29
Houses sold.....	-.33	-.43	.09	2.49
House prices.....	.07	.22	.69	.55
Housing starts.....	-.06	-.22	.69	.55
Retail sales.....	-.16	-.25	.12	.71
Per capita income...	-.06	-.08	.09	.07

TABLE 80

MULTIPLE REGRESSION SUMMARY TABLE
DEPENDENT VARIABLE--PER CAPITA
POLICE AND FIRE MEN

Variable	Multiple Coefficient of Correlation	Coefficient of Determination	Coefficient of Determination Change	Simple Coefficient of Correlation
Financial jobs.....	.97	.95	.95	.97

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter presents a summary of the conclusions reached as a result of this study. Included are suggestions for further research on the topic of industrialization and its impact on communities.

Hypotheses

The major purpose of this study was to explore the relationship between industrialization and changes in the economy and the quality of life in one selected community experiencing industrialization. Specifically, the following hypotheses were tested:

H_1 There is no relationship between changes in the private sector economy and increased industrialization in Wichita Falls, Texas.

H_2 There is no relationship between changes in the public sector economy and increased industrialization in Wichita Falls, Texas.

H_3 There is no relationship between the quality of life and increased industrialization in Wichita Falls, Texas.

Data were collected to test these hypotheses. Bivariate correlation and multiple regression techniques were used to test the relationship between industrialization and changes in selected variables which were used as representative of the private sector economy, the public sector economy, and the quality of life in the selected community. Each of these hypotheses was rejected. A summary of the three areas studied follows.

Private Sector Relationship

A summary of the relationship between industrialization and the variables used to represent the private sector economy is shown in table 81.

Of the eight variables tested, six were found to be positively related with industrialization, or with other variables which were positively related with industrialization. The evidence led to the rejection of H_1.

Public Sector Relationship

The variables which were used to represent the public sector economy were municipal expenditures, and public school system expenditures. The simple coefficients of correlation for municipal government expenditures and eight of ten of the variables from the private sector indicated a significant relationship (see table 41, p. 89). Simple coefficients of correlation for public school system expenditures and private sector variable are shown in table 43.

TABLE 81

SUMMARY OF RELATIONSHIP BETWEEN INDUSTRIALIZATION AND PRIVATE SECTOR VARIABLES

Variable	Positive Relationship	Negative Relationship	No Significant Relationship
Retail sales.....	*		
House prices.....	*		
Number of houses sold.....			*
New homes built....	*		
Bank deposits.....			*
Persons employed in construction.....	*		
Persons employed in finance.....	*		
Persons employed in retail trade.....	*		

Of these, nine of ten proved to be positively related. Multiple regression calculations showed positive relationships between the two public sector variables and private sector variables other than industrialization. This leads to the conclusion that the relationship between industrialization and the public sector is more indirect than that found with the private sector, but nevertheless clear. Thus H_2 is rejected.

Quality of Life Relationship

A summary of the relationships between industrialization and variables representing the quality of life is shown in table 82.

TABLE 82

SUMMARY OF RELATIONSHIP BETWEEN INDUSTRIALIZATION AND QUALITY OF LIFE VARIABLES

Variable	Direct Positive Relationship	Indirect Positive Relationship	No Significant Relationship	Unclear Relationship
Per capita income.....	*			
Per student school expenditures..		*		
Unemployment rate.....		*		
Infant mortality rates...			*	
Crime rate....		*		
Traffic Deaths				*
Per Capita police and fire protection.....		*		

As can be seen from data presented in table 82, the data supports the rejection of H_3. However, the results are less easily interpreted.

The problems of interpretation are compounded by the fact that the data describe occurrences over a period of time. Statistical methodology often changes and accuracy may change with time. For example, per-capita income, unemployment rates, and crime statistics may be more complete and accurate in 1977 than was found in earlier years. If this occurs, it would be incorrect to state that crime has actually increased. What would have occurred would have been, in reality, an increase in reported crime. This might be interpreted as an enhancement rather than a detriment to the quality of life. In attempting to measure the quality of the public school system, inflation-adjusted per-student expenditures were used. There exists no assurance that as expenditures go up, the quality of the service increases. Thus it is conceded that this measure is somewhat crude in its attempt to determine the relationship between industrialization and the quality of the public school system. There exists a problem in the determination and the interpretation of quality of living indicators. Yet a consensus does exist regarding the importance of the quality of life concept, the need to define it, and its significance as a potential new tool.[1] Thus the results of the analysis of the relationship between industrialization and the quality of life raise perhaps as many questions as it answers.

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[1]United States Environmental Protection Agency. The Quality of Life Concept: A Potential New Tool for Decision Makers (Washington D.C.: Environmental Studies Division, Environmental Protection Agency, 1973), p. I-1.

No significant relationship was found between the number of persons employed by manufacturing firms and the infant mortality rate. Significant relationships were found for all other variables, as indicated by the data presented in table 82. Thus, H_3 is rejected, and it is concluded that the quality of life in Wichita Falls, Texas is significantly related to industrialization. As noted earlier, depending upon the interpretation of the meaning of each of these statistics, the quality of life may or may not be enhanced by increased industrialization.

Conclusions

The evidence supports the contention that industrialization is accompanied by both costs and benefits. The private sector of Wichita Falls was stimulated by industrialization, resulting in increased business activity. Along with this economic stimulation came an increase in expenditures by both the municipal government and the public school system, suggesting a demand for an increase in the quality and the quantity of public services, or both. Consistent with studies reviewed in chapter 3, per capita income increased significantly as industrialization occurred. However, depending on one's interpretation of changes in the crime rate and the unemployment rate, costs became apparent in the examination of quality of living factors.

Future Research

There exists a need for further research regarding the relationship between industrialization and changes in the economy and the quality of life of communities experiencing industrial growth. Multiple regression techniques provide useful tools for such analysis. Case studies such as this one should provide further insight into the phenomenon of industrialization. Problems presented by time series data might be addressed in the same manner as in this study. Possible variables for inclusion in future studies might include suicide rates, library volumes, air pollution, water pollution, income distribution, and quality of housing.[2] Studies of more than one community, using data from the same year, would avoid some problems presented by time series data. Such studies should attempt to identify both industrial costs and benefits, and, when possible, to identify which are attributable to industrialization.

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[2]Recommended references for determination of suitable factors to study are Quality of Life Indicators in U. S. Metropolitan Areas, 1970, by Ben-Chieh Liv, and The Quality of Life Concept: A Potential New Tool For Decision Makers, by the United States Environmental Protection Agency.

APPENDIX

TABLE 83

VARIABLES TO TEST FOR AUTOCORRELATION
IN RESIDUALS FROM REGRESSION LINE
IN FIGURE 1

Year	Residual Zt	Succesive Differences	Zt^2	$(Zt+1-Zt)^2$
1962...	-130.75	-----	17095.562	------
1963...	-117.62	13.13	13834.464	172.3969
1964...	10.56	128.18	111.5136	16430.112
1965...	110.75	100.19	12265.562	10038.036
1966...	-27.62	83.13	762.8644	6910.5969
1967...	25.48	53.10	649.2304	2819.61
1968...	86.38	60.90	7461.5044	3708.81
1969...	110.84	24.46	12285.505	598.2916
1970...	12.16	-98.68	147.8656	9737.7424
1971...	-40.19	-52.35	1615.2361	2740.5225
1972...	-12.33	27.86	152.0289	776.1796
1973...	-29.14	-16.81	849.1396	282.5761
1974...	-43.98	-14.84	1934.2404	220.2256
1975...	-32.34	11.64	1045.8756	135.4896
1976...	77.57	109.91	6017.1049	12080.208
Totals	------	------	59150.084	66650.792

FIGURE 4

RESIDUAL PLOT FOR REGRESSION OF
MANUFACTURING JOBS WITH
RETAIL SALES

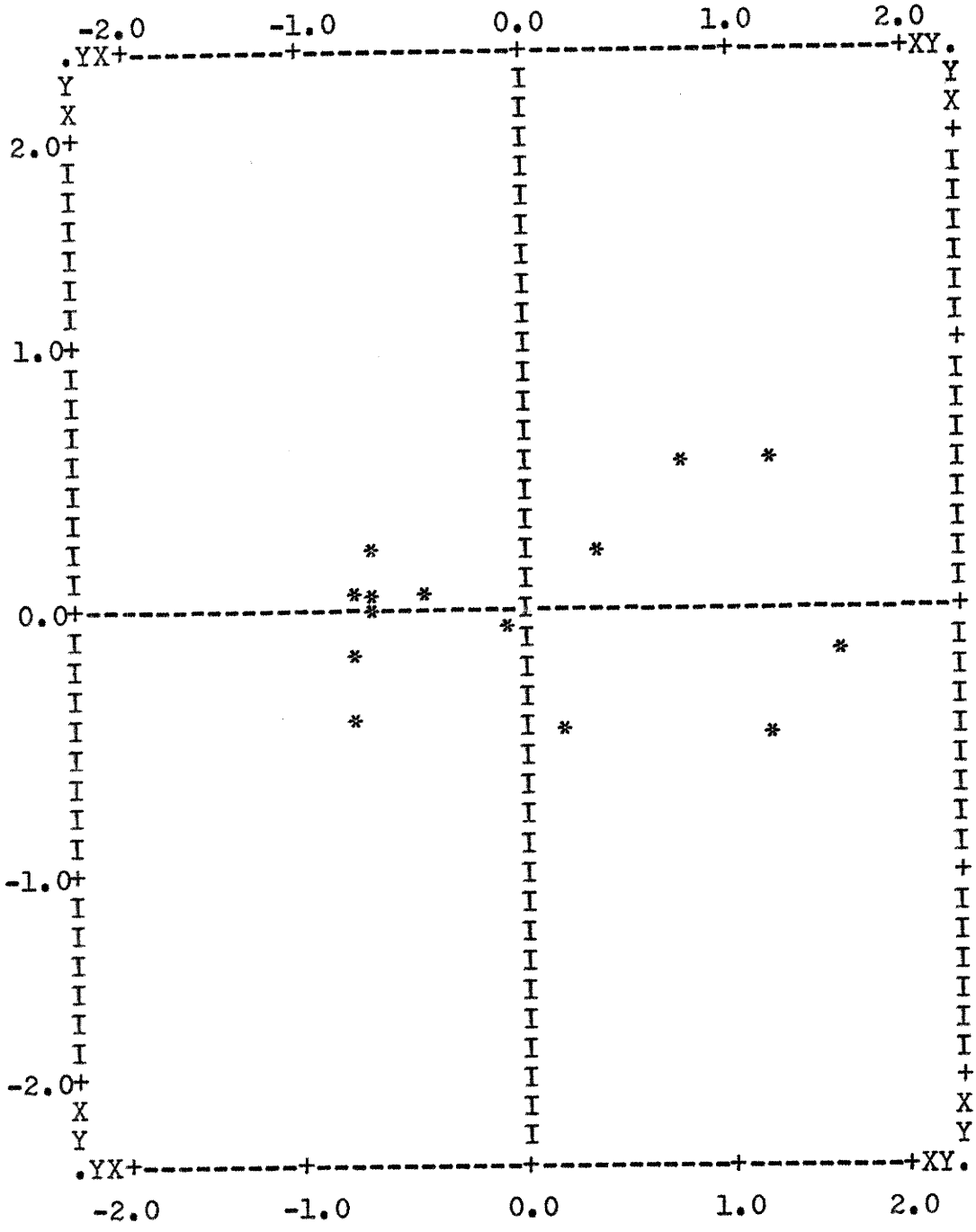


FIGURE 5

RESIDUAL PLOT FOR REGRESSION OF
MANUFACTURING JOBS WITH
HOUSE PRICES

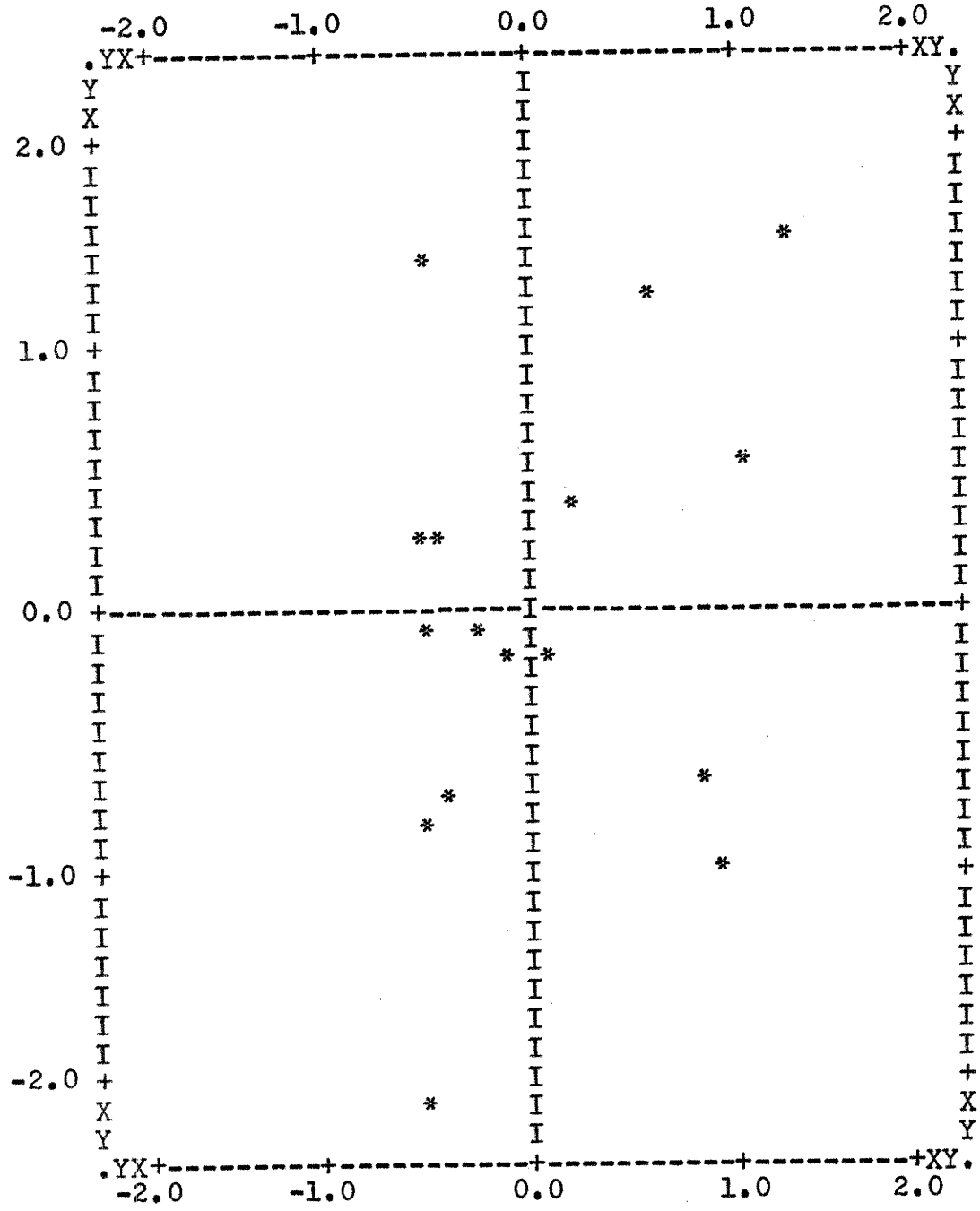
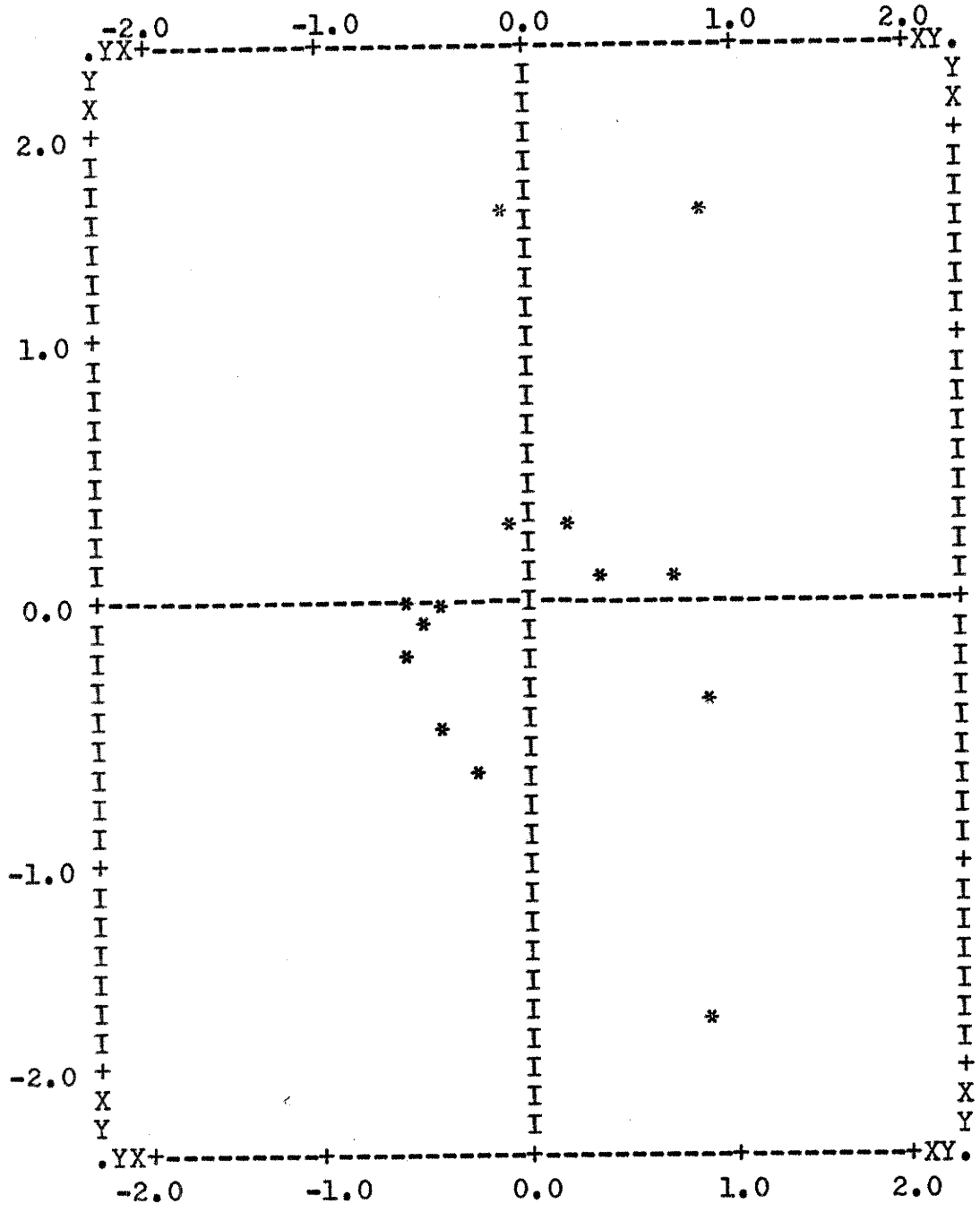


FIGURE 6

RESIDUAL PLOT FOR REGRESSION OF MANUFACTURING JOBS WITH NEW HOME BUILDING PERMITS



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