A LOCATIONAL ANALYSIS OF CORPORATE PRODUCER SERVICES IN THE DALLAS, TEXAS METROPLEX

By

JAMES MATTHEW BELL

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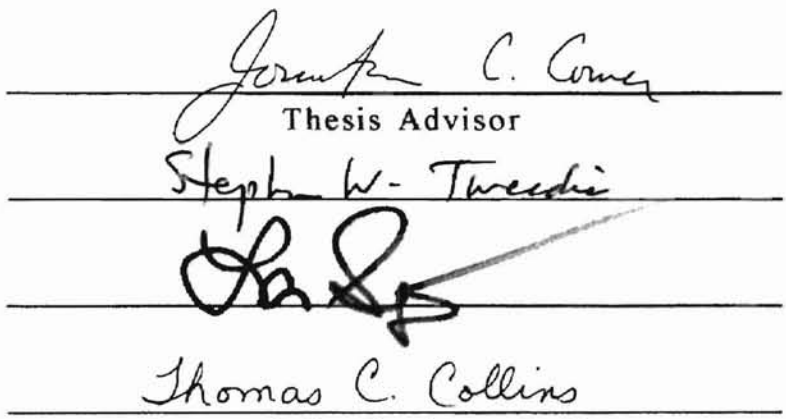

Thesis Advisor

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

American cities have undergone fundamental transformations in their economic composition and locational patterns in recent decades. Accordingly, the discipline of urban geography remains an ever-changing field in the academic realm. Sam Warner (1962) related that, "Certainly the great fascination of urban study lies in the attempt to discover some order in the vast confusion of the modern city." In the post-World War II era, cities have endured the relentless force of decentralization on virtually all fronts, a result of the middle class pushing into new frontiers in this half-century. First, they moved their homes into the suburbs of the city following World War II. Next came the suburbanization of shopping in the 1960s and 1970s, known as the "malling of America." The last step was the suburbanization of the workplace (Garreau, 1991).

For many larger metropolitan areas, the growth of central business district (CBD) office activities, fueled by the boom in white-collar employment immediately after the war, offset retail declines. Powerful linkages quickly evolved between financial institutions, law firms, insurance companies, and corporate headquarters despite a rapidly dispersing labor

pool (Hartshorn, 1992). After all, the CBD's compact nature symbolized prestige and facilitated essential face-to-face communication for its professionals. For a while, offices continued to cluster in the downtown area to take advantage of its accessibility, and the completion of the freeway system provided quick access to the area. By the end of the 1950s, however, it was apparent that the CBD could no longer retain its monopolistic hold on the corporate environment. In the wake of residential and retail dispersion, the CBD's advantageous centrality and prestige had begun to fade.

Not only did the number of corporate office space users dramatically disperse and increase during the post-war era, but also the producer services emerged as a formidable front-runner in the national economy. The growing share of these service sector jobs in the economy provided a major part of the expanding employment base in large cities in the 1970s and 1980s. Services increased from 64 to 72 percent of the total U.S. employment from 1969 to 1985 while at the same time, manufacturing declined from 25 to 19 percent (Hartshorn, 1992).

Sometimes referred to as "intermediate" services, producer services typically are defined as a combination of finance, insurance, and real estate services (FIRE); business services; and professional services (Hartshorn, 1992; Harrington, 1995). FIRE services, though predominantly consumer oriented, are included in analysis to provide a broader scope of the Dallas economy. This research examines the locational variations of producer services firms. It will revisit the modern CBD and investigate its current

role as a service sector activity center in a large metropolitan setting.

The body of literature concerning services is substantial, and much research has been published on spatial patterns at the national and interregional level. However, intrametropolitan producer services research concerning the CBD has consistently received little attention. This information gap and the inherent economic importance of producer services, therefore, presents an opportunity for investigation. At this point, it is necessary to survey the current body of research. The following section discusses a number of studies related to this thesis.

Related Literature and Studies

Aside from services, geographers who study the functions, patterns, and processes of decentralization have produced an impressive body of historical literature. With the goal of presenting a complete overview of the literature relevant to this study, this review will be presented in a two-part format. The first portion will review of some notable works for each of the following: residential, retail, and corporate decentralization. It is important to briefly examine the implications of decentralization as historical background to the evolution of American cities.

The second portion of the literature review will discuss research related to corporate service sector activities. Discussion of these journal articles will begin with those of a national and regional scope and will conclude with a number of intrametropolitan studies pertinent to the scope of this study.

Decentralization

Since large scale decentralization began in the early 1960s, numerous books and articles have been written by researchers who investigated its many implications for both the city and suburbs. An informative book on the exodus of the middle class from the central city was written by Jon Teaford in 1986. *The Twentieth-Century American City* provides a historical timeline of national economic policy, its successes and failures, and the uncoordinated development practices that left most cities struggling in the wake of competing local interests.

Federal mortgage programs introduced in the 1930s made moving to the suburbs much easier for the middle class, while the lower class and homeless remained locked within the central core of the city. It was during this era, for example, that the practice of "redlining" was established. Whereas banks had an economic motivation to maximize profits on housing loans, money was directed only toward "low risk" middle class applicants. Banks tended to award loans to new (usually middle class) residential subdivisions because existing residential areas were viewed as having a higher investment risk. This financial bias virtually crippled inner city neighborhoods. As a way to identify on maps those neighborhoods not eligible for loans, discriminatory financial institutions allegedly began outlining high risk areas with red ink.

Crabgrass Frontier (1985), written by Kenneth Jackson, describes the evolution of cityscapes from a slightly different perspective. Jackson traces the era of modern transportation and discusses the ramifications of the

private automobile and the mobilization of the American middle class. Jackson notes that despite nineteenth and early twentieth century technological advances in public transportation, the increasing availability of the private automobile during the post-war era had a pronounced impact on the rate of residential decentralization. Mass transit could meet the journey-to-work requirements, but it had not succeeded in overcoming the increasing popularity of personal mobility.

While the private automobile facilitated the middle class flight out of the city, the establishment of the interstate freeway system is perhaps most responsible for escalating the process of wholesale decentralization (Jackson, 1985). The completion of a high-speed, automobile highway from the suburbs to the CBD promptly gained acclamation. As a result, the suburbs quickly began to reflect a different landscape; the inner city resembling a social, economic, and ethnic checkerboard and the suburbs generating a homogeneous atmosphere where "middle-class purity and sobriety prevailed" (Teaford, 1986). Also incorporated into his book are accounts of the watershed acts of congress that initiated the political catalysts to decentralization, such as federal subsidies and public housing acts during the 1930s and 1940s.

Peter Muller's book, *Contemporary Suburban America* (1981), gives an enlightening view on the retail commercialization of suburbia. His book presents the reader with a broad scope of the historical, social, and economic forces that shaped the American urban landscape. Muller examines the factors and consequences of retail decentralization by

reviewing the exodus from cities following World War II, and discussing the changing life styles which altered the economic role and structure of the central city. He notes that suburban shopping centers provided the foundation for attracting large agglomerations of office activities, beginning with manufacturing sales offices and continuing with computer, research, and other service firms.

Truman Hartshorn's 1992 edition of *Interpreting the City: An Urban Geography* provides an understandable textbook account of the corporate expansion beyond the bounds of the CBD. It's comprehensive, yet redundant text devotes individual chapters to the description and explanation of the complementary nature of central and suburban retail and office location. Several major reasons are advanced as to why corporations began to opt for the fringe of the city. First and foremost, corporations moved out of the central city in order to locate close to the middle class, which comprised a large percentage of the office work force. This meant a shorter journey to work for workers, and most importantly, the key executives.

The suburbs offered large, undeveloped tracts of land on which to build. This facilitated the campus style corporate office complex, which offered a quieter and more relaxed atmosphere, promoting greater efficiency and lower turnover rates among employees. The periphery was also devoid of many external factors, such as crime and violence, that typically disrupted the operations of the business in the central city. Moreover, easier access to public transportation facilities, primarily major airports,

was a decisive factor in corporate locational trends.

Hartshorn (1992) concludes:

> Suburban office growth began in the 1960's as office parks chose sites offering freeway accessibility. Sales offices, [clerical] back offices, and regional headquarters activities filled those facilities. As the suburban commercial market matured, it attracted more specialized office functions, including corporate headquarters and a wide array of [producer] services. Today, suburban office functions are concentrated in "downtown" cores that rival or exceed the size of the central business district. Unlike retailing, however, suburban office space is much more clustered (420).

Perhaps the most innovative literary (non-scientific) research is journalist Joel Garreau's book *Edge City: Life on the New Frontier* (1991). Garreau traveled the U.S., studying more than 200 edge cities around the 35 largest urban centers. During his investigation, he coined the term "edge city," describing the suburban office nuclei which were the subject of his study. His book outlines the basic attributes of a typical edge city and he synthesized a general definition which many consider a functional benchmark.

According to this definition, an established edge city:

- Has five million square feet or more of leasable (multi-tenant) office space.
- Has 600,000 square feet or more of leasable retail space.
- Has a population that increases at 9 a.m. on workdays; marking the location as primarily a work center.
- Has a local perception as a regional end destination for jobs, shopping, and entertainment, and;

- Has a history in which, thirty years ago, the local land use was predominantly agricultural and/or residential.

These office nuclei, previously referred to as "technoburbs" or "suburban downtowns," once again combined residence and workplace in a single location quite amazingly in the same fashion as the original downtown. Despite similarities, edge cities are nevertheless quite different from the old CBD. Generally, they lack character, as reflected in the stark architecture of their buildings. Edge cities are by no means planned. Totally dependent on the automobile, they are exclusively interstate freeway phenomena. They have no sidewalks, no organized local transportation, and are recognized by the jogging trails around the hills and ponds of their disaggregated corporate campuses (Garreau, 1991).

Recent attention to the national distribution of corporations is evident. Sociologist Sally Ward conducted a regional analysis of office location entitled, "Trends in the Location of Corporate Headquarters, 1969-1989" (1994), in which she examines the regional distribution and decentralization of corporate headquarters in the United States by separating the nation into its four aggregate census regions: Northeast, Midwest, South, and West (no explanation or map defining these regions was given!). For the years 1969, 1979, and 1989, information on location of corporate headquarters was recorded for six classes of corporations: the 500 largest industrial firms, and the 50 largest banks, insurance companies, retail firms, transportation companies, and utilities. The sample population was taken from *Fortune* magazine.

The data indicate that the Northeast sustained a substantial reduction in the total number of corporations while the Midwest experienced a more moderate decline. At the same time, the South experienced a large increase while the West displayed little change. Ward cautions, however, that these patterns are not consistent across types of corporations. Banking remained concentrated in the Northeast, the region that suffered the largest reduction in industrial and retail activity. The Midwest appeared to lose ground in every category, with the exception of transportation and the South gained in all except insurance. The West was a mixture of increases (insurance, retail, utilities), decreases (banks, transportation), and little change in industrial corporations (Ward, 1994).

Another interesting and pertinent point is presented in Table 1. Data reveal that for each year and corporation type, the vast majority of headquarters are located in metropolitan areas, particularly central cities (central city does not signify CBD, but the primary city of the metropolis). It is not surprising to see that the largest decline (-13%) in the central cities occurred during the first decade (1969-1979), a trend which parallels previous documentation of slowing decentralization trends in American cities (Frey and Speare, 1988). The suburban share increased (+78%) during the same decade. All corporate categories declined; however, the central cities still retain the majority of headquarters. Banking and insurance have the highest percentages in the central city, with more than 90% of headquarters remaining. By contrast, the retail and industrial categories are the most decentralized.

Type of Corporation	Metropolitan Status: Central City %	Suburban %	Nonmetropolitan %	n
Industrial				
1969	79	16	5	500
1979	67	28	5	500
1989	62	30	8	500
Banking				
1969	98	2	0	50
1979	96	4	0	50
1989	96	4	0	50
Insurance				
1969	94	4	2	50
1979	94	4	2	50
1989	92	8	0	50
Retail				
1969	80	20	0	50
1979	64	34	2	50
1989	56	40	4	50
Transportation				
1969	100	0	0	50
1979	84	12	4	50
1989	70	26	4	50
Utilities				
1969	92	8	0	50
1979	88	12	0	50
1989	82	18	0	50
Total, all types				
1969	84	13	3	750
1979	73	23	4	750
1989	68	26	6	750

Source: Ward (1994)

Table 1: The Distribution of Corporate Headquarters, by Metropolitan Status, 1969-1989

Corporate Services

Research about the extent, causes, and implications of the explosion of service activities during the past fifteen years has verified the increased proportion of employment in these activities, their tendencies toward concentration, their structural role in local economies, their potential to form part of a region's economic base, and their importance in assisting other activities in the regional economy (Harrington, 1995). Herein, studies conducted on regional/national scale appear first, followed by intrametropolitan research.

An excellent regional investigation is "The Location and Growth of Business and Professional Services in American Metropolitan Areas, 1976-1986" (O hUallachain and Reid, 1991). Using employment data for Standard Metropolitan Statistical Areas (SMSAs), the authors present empirical evidence verifying the concentration of business and professional services in the largest metropolitan areas and a temporal lag in their market penetration of smaller metropolitan areas. They also introduce a new measure called the growth quotient to show that these services are rapidly growing in selected regions. The quotient is derived as follows. First, the normalized growth of business and professional services for an SMSA and the nation is calculated by subtracting from each the rate of growth of total employment. The growth quotient of an SMSA is the ratio of these two normalized growth rates. They note that SMSAs in the old industrial belt rely on business and professional services to generate new jobs (Figure 1) while elsewhere, the metropolitan economies are more diversified.

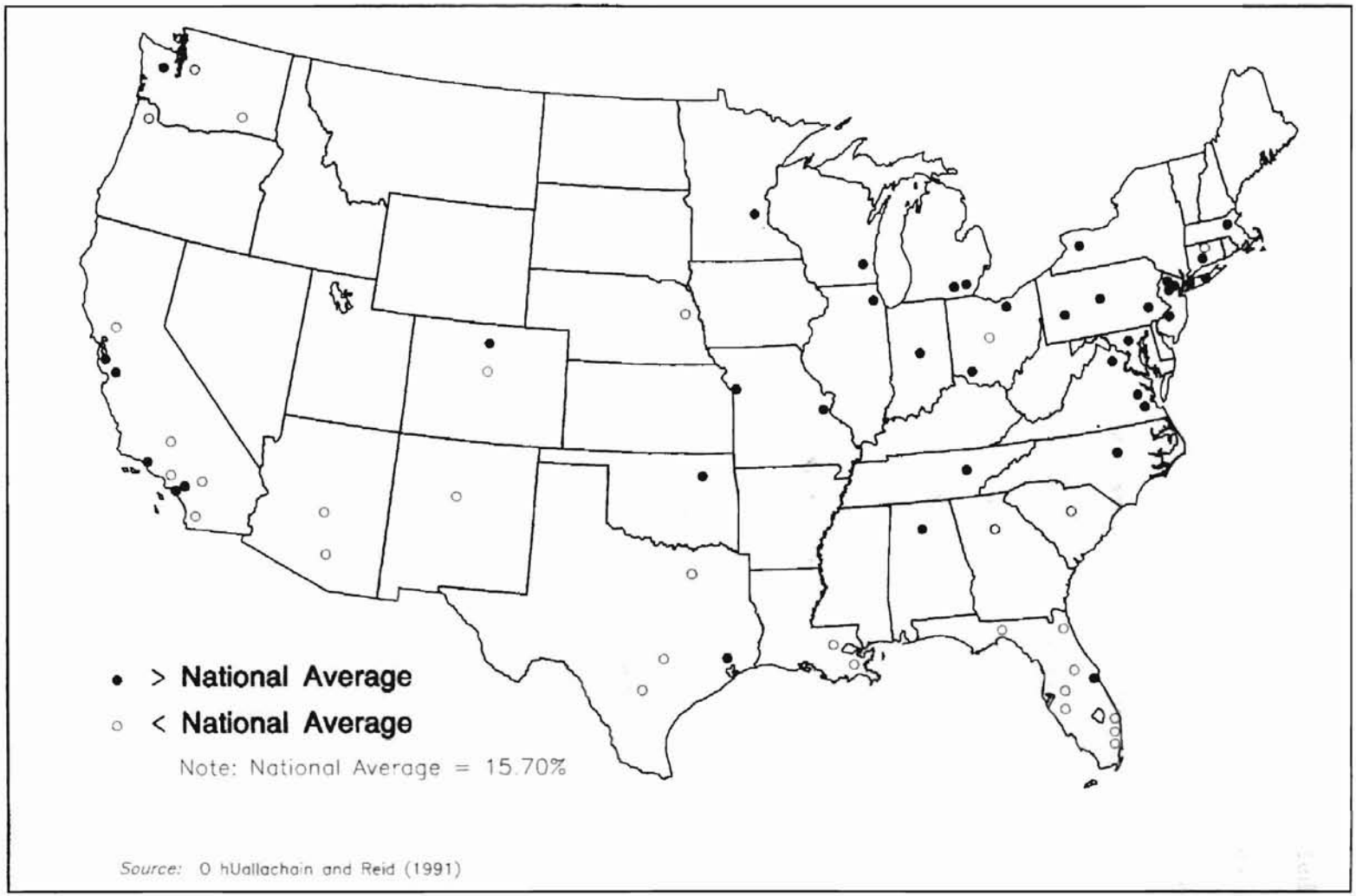


Figure 1:
Metropolitan Area Job Growth in
Business and Professional Services, 1976-1986

Their empirical results support three conclusions. First, employment in business and professional services is inherently concentrated in large metropolitan areas. In particular, the New York, Los Angeles, Chicago, and San Francisco areas dominate. Within these and other large SMSAs, central counties tend to dominate. Second, convincing evidence shows that decentralization occurred during the study period. The most interesting facet of this, they say, is the relative rapid growth of these services in areas such as Detroit, Denver, Dallas, Boston, and Austin, among others. Third, business and professional services are generating most of the new jobs in large Midwestern and western SMSAs while southern and western areas exhibited diversified growth.

"Spatial Divisions of Corporate Services Occupations in the United States, 1983-88" (Ettlinger and Clay, 1991) examines regional corporate services using the concept of "spatial divisions of labor." It investigates the geographic variation between non-routine and routine employment. Non-routine is defined as high-wage, high-skilled centralized administrative and corporate services activities, typically those of face-to-face contact. Routine employment is generally peripheral production based, low-wage, and low-skilled labor. Using the *Geographic Profile on Employment and Unemployment* published by the U.S. Department of Labor, the authors examined occupational data across the nine census divisions (Figure 2) continuously from 1983 through 1988. Location quotients (LQs) are then used to identify a "core" with respect to concentrations of control-related non-routine activity. LQs are used to describe the concentration of

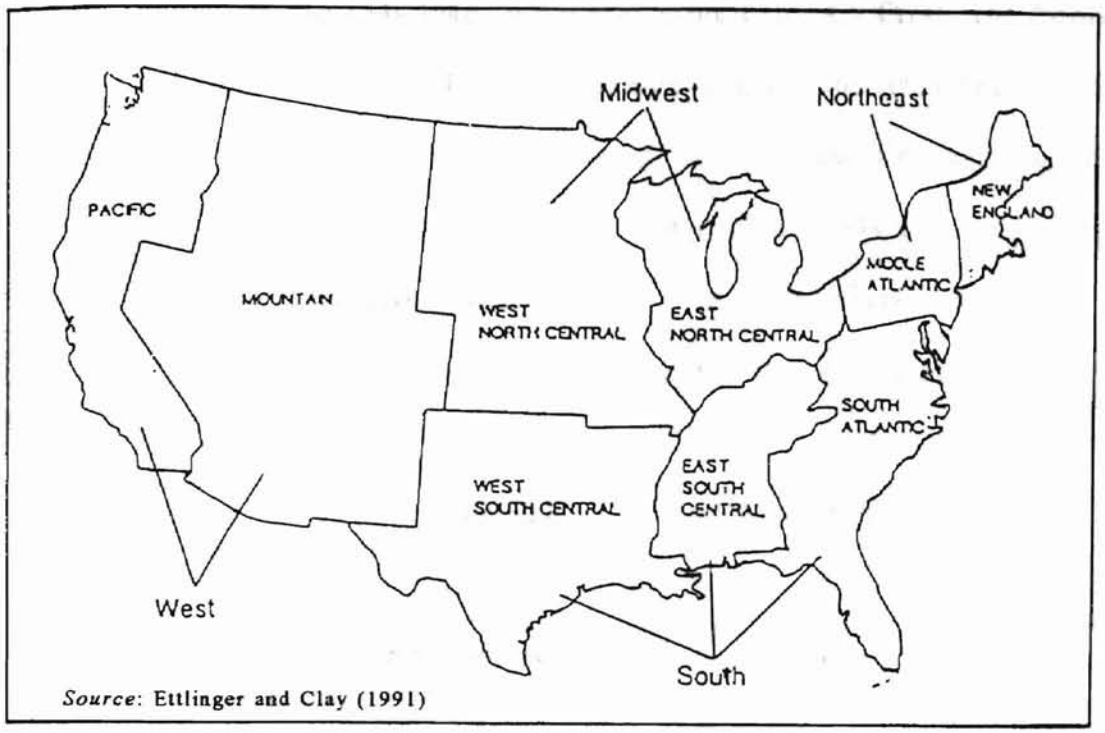


Figure 2: U.S. Census Divisions and Aggregate Regions

economic control relative to employment by comparing the regional share of an occupation to the regional share of the nation's employment, facilitating regional comparisons and identification of dominant and subordinate regions (census divisions). The LQ is calculated as follows:

$$LQ_i = \frac{RE_i / NE_i}{RE / NE} \qquad (1)$$

where: RE_i = regional employment for occupation i in a given year

NE_i = national employment for occupation i in a given year

RE = total regional employment in a given year

NE = total employment for the nation in a given year

Indications of the LQs lead to several conclusions. First, the "core" of non-routine activities in the U.S. is not one contiguous area (Figure 3). The core appears to be coastal, consisting of the New England, Middle Atlantic, and Pacific divisions. Second, non-routine LQs exhibit general distance decay inward from the coasts, meaning divisions that are geographically close to the dominant coastal divisions have relatively higher LQs than those in the interior U.S. Third, throughout the six-year study period, the LQs of the core area remained virtually stable, though some evidence of deconcentration movement to the Sunbelt, South Atlantic, and West South Central divisions was noticed. Fourth, routine services are

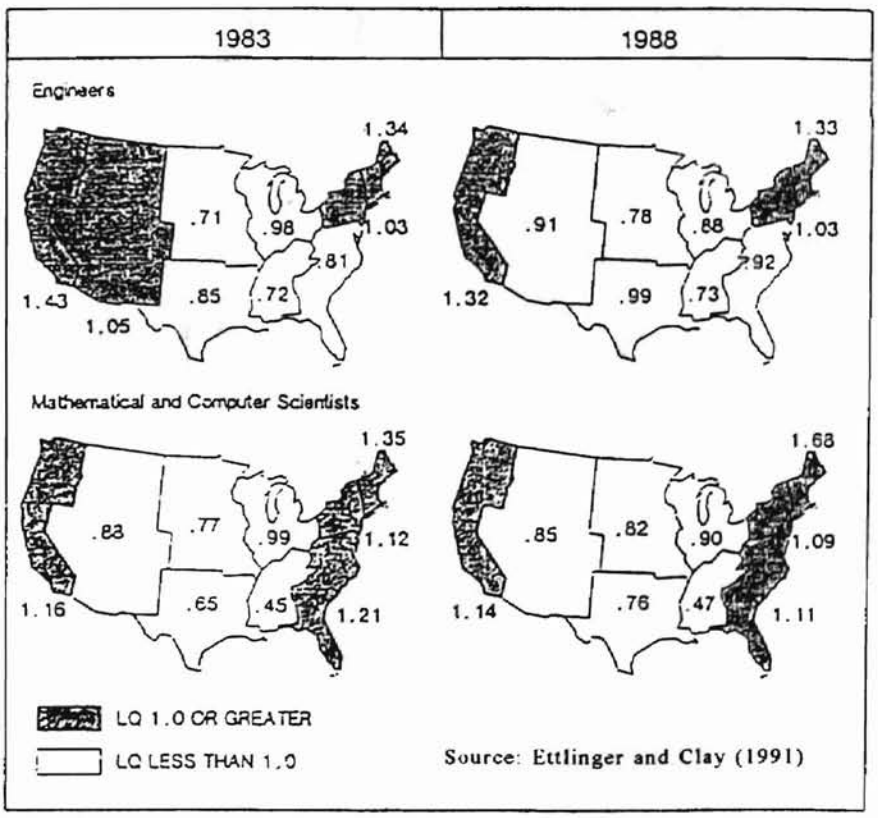


Figure 3: Location Quotients for Selected Non-Routine Occupations

generally less concentrated than non-routine services (Figure 4). This is not surprising, they note, because skill requirements for routine activity are limited and low-skilled labor tends to be ubiquitous. Finally, clear spatial divisions of labor were evident at the end of the study. This study concludes that regional patterns exist and that these patterns are intelligible in terms of a spatial separation of routine and non-routine activity (Ettlinger and Clay, 1991).

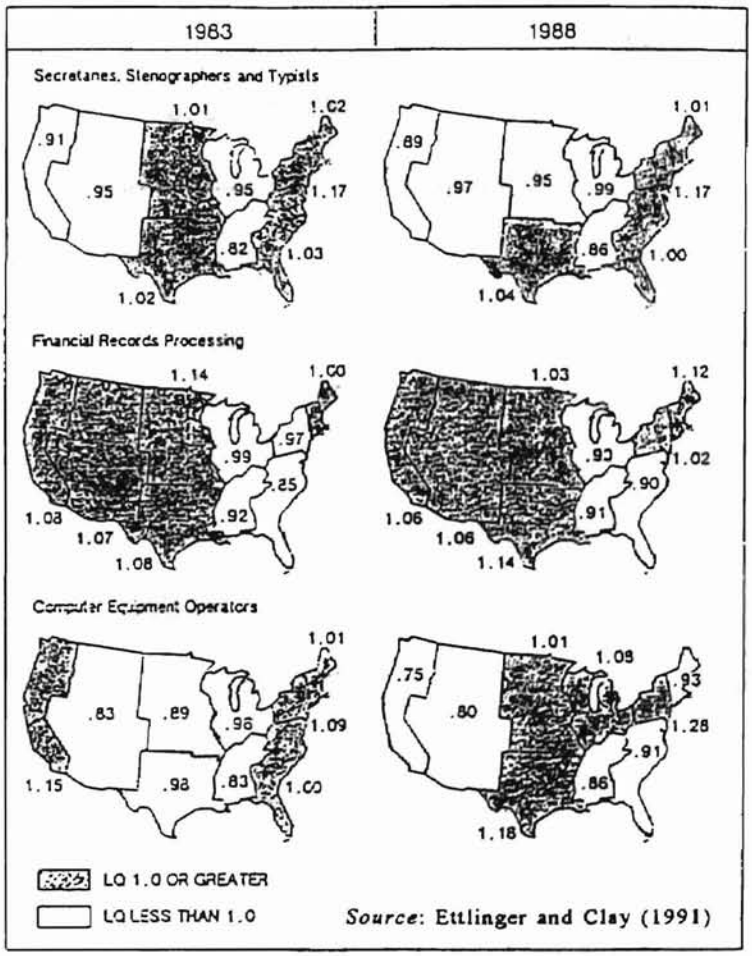


Figure 4: Location Quotients for Selected Routine Occupations

"An Exploratory Study of Office Location Behavior in Greater Seattle" (Daniels, 1982) gives some early insight into the intrametropolitan office activities of Seattle. This paper examines the relationship between public policies for office development and empirical evidence of office location change within the metropolitan area. Greater Seattle was chosen as the study area because it has a highly centralized office economy, unlike the majority of other metropolitan areas. A mail survey was used to collect data on the movement of offices, the reasons for location choice, and the evidence of in-migration from outside the Puget Sound region. The investigation centered on finance, insurance, and real estate, business services, and miscellaneous services.

The survey found that decentralization has taken place during the 1980s, but the downtown area, which contains the vast majority of all metropolitan office space, has apparently discouraged large-scale out-migration. Furthermore, most office relocation has been over relatively short distances within the downtown area or within a nearby suburban center. This stands to reason, in light of the fact that Seattle officials have promoted the CBD as an office center over adjoining suburbs, who are also actively promoting their centers.

This conflict of interest reflects local public growth policy in Seattle. City fathers have created a set of preconditions that are aimed at turning support to growth in the CBD. It is argued that new buildings in the CBD involve only a marginal cost investment for new services, and improvement of CBD-oriented public transit will be more energy efficient than the almost

total dependency of suburban areas on the automobile. Suburban areas, meanwhile, have adopted their own set of incentives, including plans for local transportation networks.

The results of locational choice analysis revealed that overall, client access and suitability of premises are the most important factors among business services. Miscellaneous services sited suitability of premises as the top reason followed by client access and operational cost. Finance, insurance, and real estate services were not as clear cut, according to the author. In this case, these offices cited "other reasons" because most were not headquarters offices and had no part in locational decisions.

A second intrametropolitan study, "Office Location and the Density-Distance Relationship" (Smith and Selwood, 1983), tests a different perspective. This paper takes on a somewhat more theoretical approach to the study of office location, dividing it into three parts. First, they review office location research aimed at formulating hypotheses regarding office decentralization. The second part examines the relationship between density of office land use and distance from the center of the city. Finally, and most importantly for this thesis, the results of the analysis are discussed within the context of their implications for future research in this area. For the purposes of this study, metropolitan Columbus, Ohio was chosen for the period 1964-1981.

Four interrelated hypotheses were formulated. First, there is an inverse relationship between office density and distance from the center of the city. Second, the degree and timing of decentralization will vary by

type of office function. Third, different types of office land use will vary in the extent of their absolute and relative decentralization. The term "absolute" refers to a decrease in central density and an increase in suburban density while "relative" means an increase in central density accompanied by a proportional increase in suburban density. Fourth, there will be different regions of destination for different types of offices.

Table 2 shows the economic sectors used in the study and the gradient results. Gradient is defined as a proportional decrease in office density to increasing distance from the center of the city. Density gradients were measured for the years 1964, 1970, and 1981. Because of areal growth of the functional study area, 1981b reflects a slightly larger area than that of 1981a. As gamma (γ) increases, there is a growing concentration of office space toward the center of the city. Ranging from 0 to 1, it is an absolute measure of density gradient. D(0) is defined as the density of office space at the center of the city as measured in square feet per acre. The coefficient of determination (R_2) functions as a relative strength index. In this form, it ranges from 0 to 100 and can be interpreted as the percentage of variation in each service category (dependent variable) that is explained by the total category (independent variable).

Results indicate several findings. Almost all types of office land use experienced decreases in density gradient from 1964 to 1981. In 1964, business services exhibited the highest degree of concentration. Finance, professional services, and miscellaneous services were at about the same

Sector		1964	1970	1981a	1981b
Total	Y	0.38	0.36	0.32	0.33
	D(0)	1079.90	1303.6	1881.8	2100.6
	(R-sqrd)	(0.87)	(0.87)	(0.72)	(0.75)
Finance	Y	0.46	0.44	0.29	0.31
	D(0)	379.93	441.42	273.14	330.29
	(R-sqrd)	(0.77)	(0.75)	(0.68)	(0.72)
Business	Y	0.63	0.53	0.51	0.43
	D(0)	340.35	354.25	441.52	275.88
	(R-sqrd)	(0.82)	(0.78)	(0.68)	(0.65)
Professional	Y	0.44	0.42	0.27	0.36
	D(0)	228.15	230.44	160.77	290.03
	(R-sqrd)	(0.79)	(0.77)	(0.72)	(0.72)
Government	Y	0.32	0.32	0.34	0.35
	D(0)	26.05	24.29	44.25	46.53
	(R-sqrd)	(0.34)	(0.33)	(0.32)	(0.47)
Miscellaneous	Y	0.49	0.46	0.33	0.35
	D(0)	518.00	626.41	623.70	780.55
	(R-sqrd)	(0.83)	(0.78)	(0.67)	(0.74)
Utilities	Y	0.43	0.41	0.63	0.45
	D(0)	0.17	0.20	2.56	0.80
	(R-sqrd)	(0.26)	(0.23)	(0.40)	(0.41)

Source: Smith and Selwood (1983)

Table 2: Floor Space Density Gradient Coefficients, By Sector

level, but had a much lower density gradient. Government, not surprisingly, had the lowest density gradient. In 1970, everything was about the same, though the business service sector exhibited more decline. By 1981, business services had remained the most concentrated, while finance, insurance, and real estate had become the least concentrated.

The authors conclude that there has been overall relative decentralization, meaning that growth has occurred in both central and suburban parts of the metropolitan area. The exception was government

offices. This stabilized gradient reflects the continual existence of local suburban governments. Additionally, office space associated with professional services tends to be strongly centralized, whereas financial, insurance, and real estate have become more dispersed. Finally, it was revealed that decentralization in the Columbus area was over a short distance of approximately 20 km. The authors close by commenting that it would be useful to see similar studies conducted in other cities in the U.S.

O hUallachain and Reid conducted further research in "The Intrametropolitan Location of Services in the United States" (1992). In this study, they investigate land trade-off and information costs among service firms. They discovered that the firms that gain the most from access to the knowledge and know-how of other firms in the same sector are willing and able to pay for expensive central city land. Table 3 lists the 22 disaggregated sectors used in the analysis. The sectors were adapted from a service classification by the U.S. Department of Commerce.

Analysis focused on the proportion of jobs in the central cities of metropolitan areas. Two measures of intrametropolitan location were calculated. These were the mean and the coefficient of variation (standard deviation divided by the mean, expressed as a percentage) of the proportion of a sector's metropolitan jobs in the central city. The mean was then used to make intersectoral comparisons while the coefficient of variation was used to assess relative dispersal.

Results of the study indicate that legal services, advertising, and

SIC *	Sector	Mean	Coefficient of Variation
	Total Employment	0.35	56.0
	Aggregate Services	0.50	41.1
81	Legal Services	0.74	22.4
731	Advertising	0.65	30.7
872	Accounting, Auditing	0.59	31.1
733	Mailing, Reproduction	0.58	38.7
738	Misc. Business Services	0.57	39.7
736	Personnel Supply Services	0.57	38.6
823,4,9	Educational Services	0.56	40.4
734	Services to Buildings	0.55	44.2
732	Credit Agencies	0.55	47.5
871	Engineering, Architectural Services	0.52	47.7
70	Hotels	0.52	36.7
737	Computer Programming Services	0.48	58.8
75	Automobile Repair Services	0.47	47.3
874	Management, Public Relations	0.47	47.0
72	Personal Services	0.46	46.7
76	Misc. Repair Services	0.44	54.7
80	Health Services	0.44	49.5
873	Research, Development Labs	0.43	67.5
89	Services N.E.C.	0.43	50.1
735	Equipment Rental Services	0.40	51.5
78,79,84	Amusement, Recreation Services	0.37	54.5
83	Social Services	0.36	56.4

* Standard Industrial Code

Source: U.S. Department of Commerce, 1989

Table 3:
Center City Proportions of Service Sector Employment
in Sample Metropolitan Areas in 1987

accounting/auditing services are the most centralized services in the 74 largest metropolitan areas of the United States. Legal, advertising, and accounting/auditing services employment had the highest central city means and the lowest coefficients of variation. As they expected, employment in health, social, and amusement services were largely suburban. Other types of services, including computer and data processing, research and

development, and equipment rental were found to be widely scattered in throughout metropolitan areas.

The authors argue that the presence of strong input-output linkages within the central city are not a satisfactory explanation for clustering of high-order services in the central city. Most interfirm collaboration in central cities is probably intrasectoral. For example, lawyers will collaborate with other lawyers, accountants form alliances with accountants, and advertisers interact with advertisers. Decision-makers in more decentralized sectors, such as computer and data processing, are less dependent on intrasectoral information exchanges.

This study is the only one found that conducted a locational analysis of selected services concerning the CBD of a central city. Seven maps of the Phoenix, Arizona area were produced, each showing the location of an individual service. The maps confirmed that central city service jobs are clustered in a small section of the city. Their findings indicate that advertising, personnel, management, accounting, and architectural services cluster in or close to the Phoenix CBD. Clustering by computer and research services in suburban areas was less evident. The authors make clear that these maps are not representative of other metropolitan areas. This presents an excellent opportunity to further research concerning central business districts.

CHAPTER II

DESCRIPTION OF STUDY

Research Purpose and Objectives

The purpose of this study is to examine the central business district's current role and relationship with the metropolitan area by studying the distribution of producer service firms. The Dallas, Texas metroplex is an extraordinary specimen of extensive decentralization, particularly in office activities. The CBD is large, but suffers from exceptionally low occupancy rates. On the surface, it appears that despite low occupancy, the CBD dominates in the absolute numbers of some types of service firms. On the contrary, other types of services tend to be located outside the downtown area.

This research will address the following questions:

1) What types of services cluster in the Central Business District?
2) How does the intrametropolitan location of non-CBD services vary?
3) Is there a correlation between firm size and locational tendency?

In order to investigate these questions, the following hypotheses will be addressed:

1) Despite extensive decentralization, financial and professional services are the most centralized, allowing the CBD to retain functional economic importance in the metroplex.
2) Decentralized services cluster rather than disperse in areas outside the CBD.
3) Large service firms tend to locate in the central business district.

Justification of Research

This section argues two points. First, assessment of published research has revealed a need for further investigation. A number of articles were reviewed earlier. Half are the latest research of interregional scope (O hUallachain and Reid, 1991; Ettlinger and Clay, 1991; Ward, 1994). The other half (Daniels, 1982; Smith and Selwood, 1983; O hUallachain and Reid, 1992) are the most recent intrametropolitan research articles. Of these, O hUallachain and Reid (1992) have advanced the only apparent research to incorporate a CBD into locational analysis. The remaining two articles, while indirectly discussing the CBD, are overtly concerned with *central city* and suburbs. In addition, O hUallachain's and Reid's research (1992) failed to analyze the activities of finance, insurance, and real estate,

an intrinsic part of the producer services sector. Therefore, research has not fully examined producer services at the intrametropolitan level.

Second, recent declines in nationwide manufacturing employment have coincided with a significant rise in service sector employment (Harrington, 1995). Furthermore, as mentioned previously, the Dallas CBD has experienced notoriously low occupancy rates since the mid-1980s and is of great concern to local leaders. Currently, vacancy in the CBD is more than 36 percent (Table 4). Therefore, with Dallas' sizable service

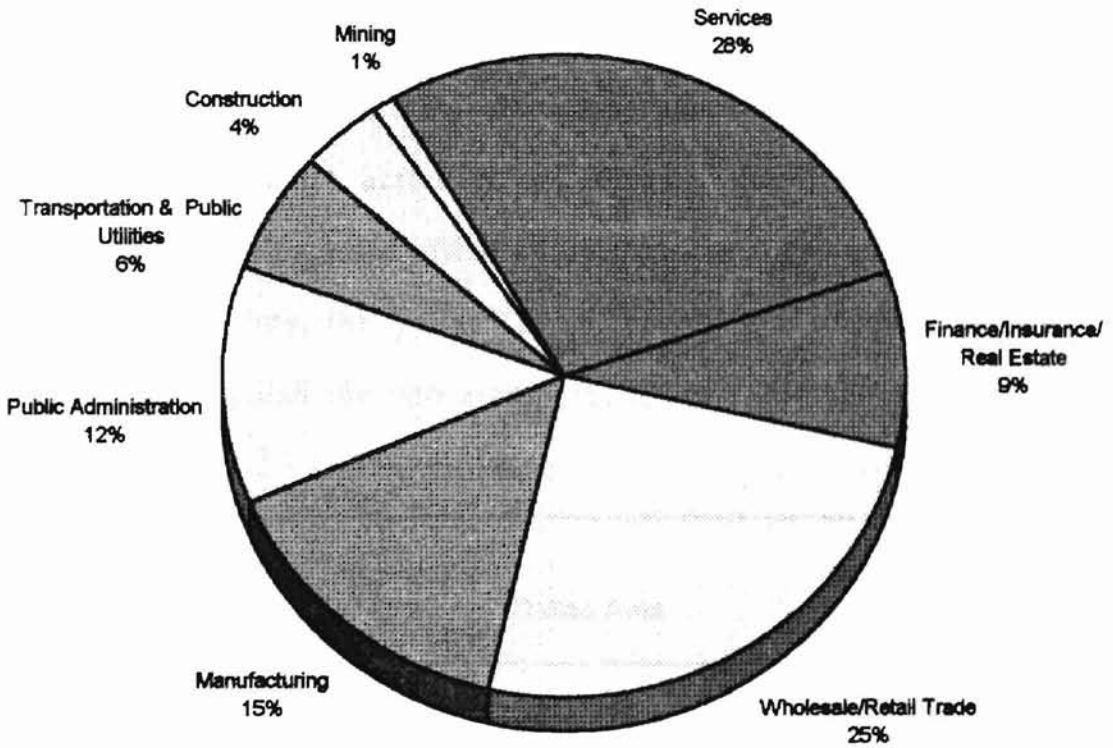
TOTAL OFFICE MARKET	
Inventory	126,891,217 s.f.
Direct Available Space	28,312,223 s.f.
Overall Vacany Rate	22.9%
Average Rental Rate	12.63 per s.f.
Absorption* YTD	4,006,122 s.f.
CBD	
Inventory	30,467,722 s.f.
Direct Available Space	11,028,179 s.f.
Overall Vacany Rate	36.4%
Average Rental Rate	$12.87 per s.f.
Absorption* YTD	-965,038 s.f.
NON CBD	
Inventory	96,432,495 s.f.
Direct Available Space	17,284,044 s.f.
Overall Vacany Rate	18.6%
Average Rental Rate	$12.48 per s.f.
Absorption* YTD	4,971,160 s.f.

* net change in leased space

Source: *Focus on Dallastrends, Year-end 1994*, Cushman & Wakefield

Table 4: Dallas Area Office Market Statistics

employment (Figure 5), this study will produce useful information relevant to any revitalization efforts in the downtown area. An understanding of the relationship between the central business district and the rest of the metropolitan area will be helpful in resolving the lingering problems of the downtown area of Dallas, and in other cities with similar conditions.



Source: Business and Industry, 1995

Figure 5: Dallas Area Employment by Sector

Scope of Study

The following are descriptive explanations and boundary definitions for the Dallas Metroplex and the study area.

For the purposes of this research, the Dallas metroplex is defined as including the city of Dallas, and its contiguous suburban cities, most of which lie in Dallas County. It is part of the Dallas/Fort Worth metroplex, shown in Figure 6, and is located in the Central Time Zone in North Central Texas 35 miles to the east of Fort Worth. The adjoining Fort Worth metroplex is not included in this study due to inherent differences in the volume of office activity. In comparison to Dallas area office space (Table 5), Fort Worth activities are virtually non-existent. In fact, the Dallas CBD contains more office space than that of the entire Fort Worth area. For this study, the Dallas/Tarrant county line serves as an adequate border to distinguish the two areas.

	Dallas Area	Fort Worth Area
CBD	30,467,722 s.f.	7,715,803 s.f.
NON CBD	96,432,495 s.f.	14,849,374 s.f.
Total	126,891,217 s.f.	22,565,177 s.f.

Source: *Update '95*, CB Commercial

Table 5: Total Office Space, Dallas and Fort Worth

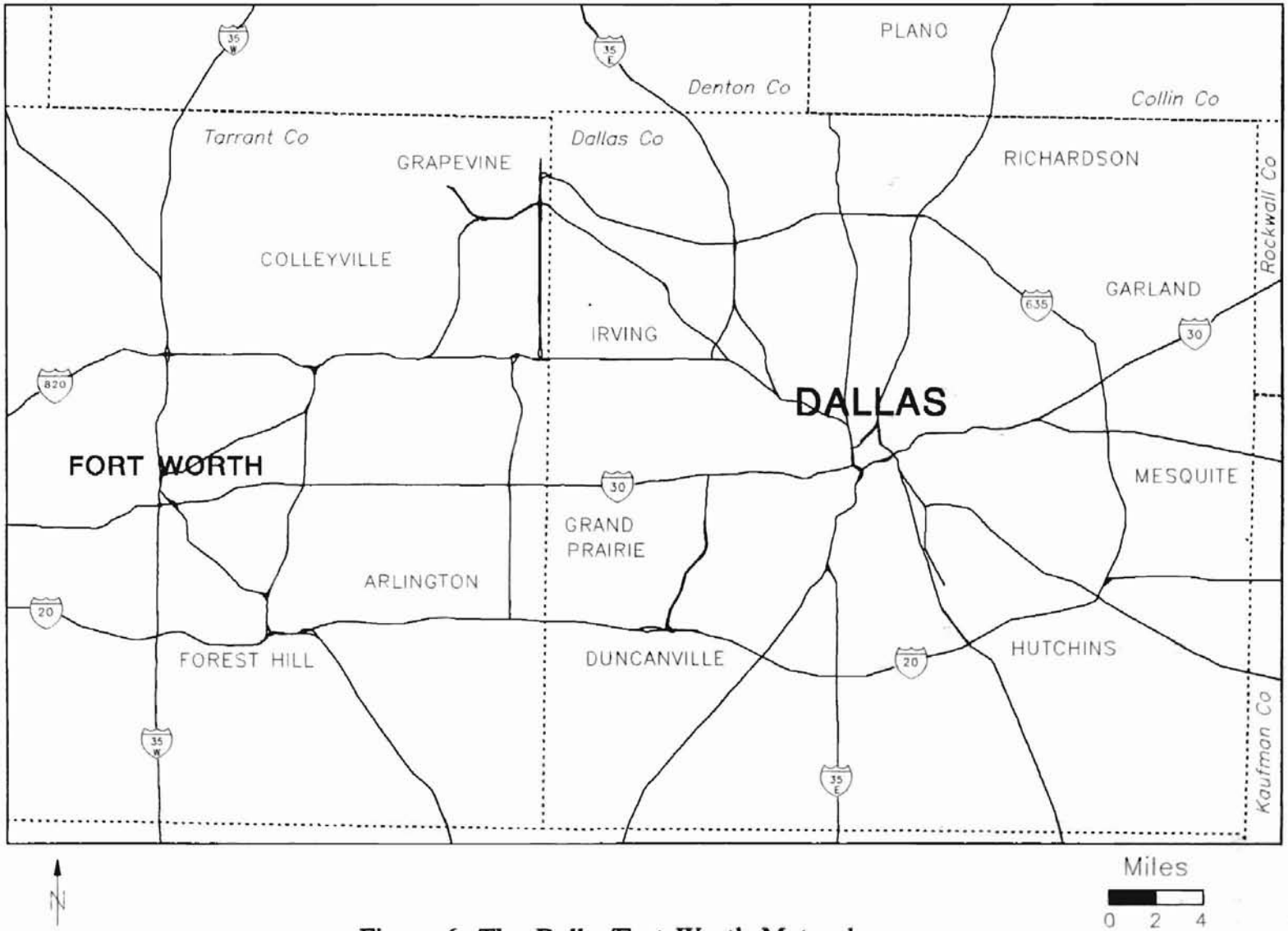


Figure 6: The Dallas/Fort Worth Metroplex

Figure 7 shows the study area. This area, signified by dashed lines, contains an area of approximately 388 square miles. The area was derived by first locating all firms in the sample population defined on page 35. Once this was accomplished, the study area boundary was reduced to the smallest region possible while still including all sample firms. This reduces the clustering bias to the lowest possible degree, thus allowing for a more accurate analysis. Local office guides and on-site investigations have verified that the study area encompasses virtually all of the office space in the Dallas area.

The Dallas central business district (shaded area, Figure 8) is bounded by interstates I-30, I-35, U.S. highway 75, and the Woodall Rodgers Freeway. This definition is widely accepted and is identical to definitions used by local business and real estate publications. Generally recognized for its historical prestige, the CBD contains 84 buildings on approximately 1.5 square miles in area (*Black's Office Guide*, 1995).

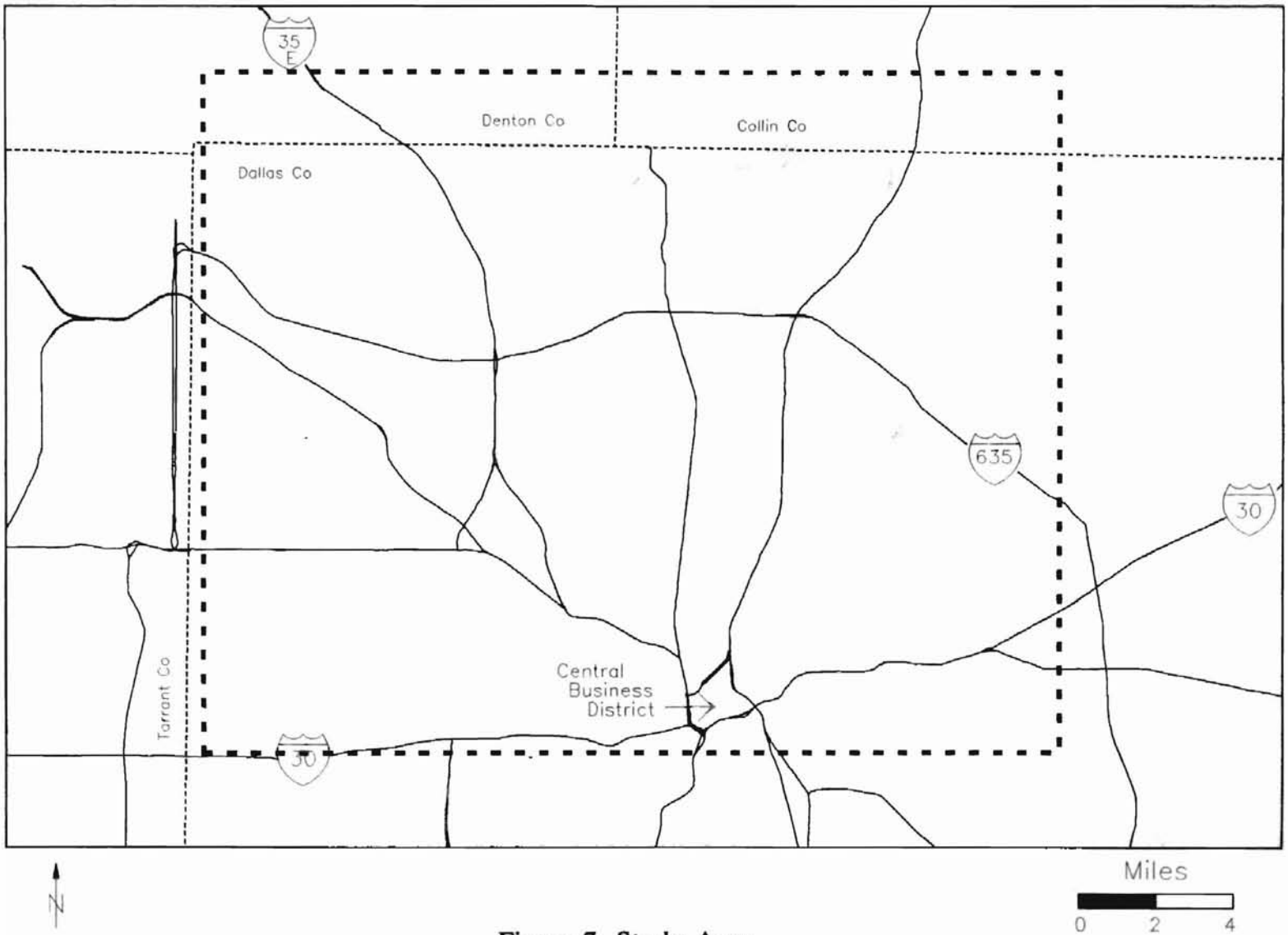


Figure 7: Study Area

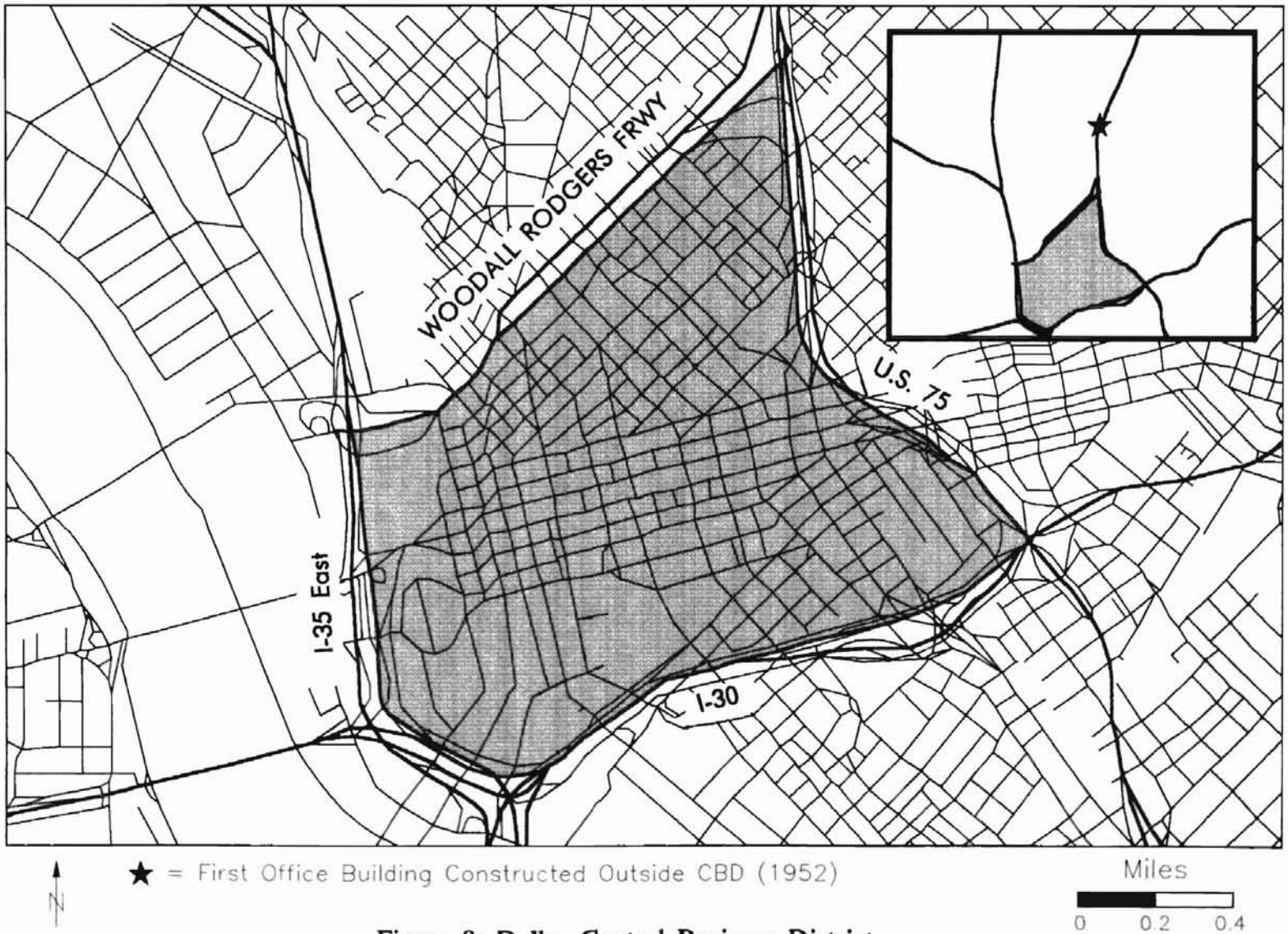


Figure 8: Dallas Central Business District

Data Collection

Many data sources discussed in this section are products of the Greater Dallas Chamber of Commerce Research and Information Division. Other sources are private sector services. In order to minimize data errors, as many sources as possible of identical data were collected. This section provides a description of the data sources used for this research.

The main data source was the *Dallas Business and Industry Journal* for Summer/Fall 1994-1995. This journal is published annually as a service of the Dallas Chamber of Commerce. The journal contains information on 732 companies and provides specialized listings, including the largest 200 Dallas area employers and the top 20 employers within 34 industries, among others. The top 20 employers section provided the pool from which the sample population of service firms was drawn. This section lists the firm name, rank by employment, its headquarters location and year established locally, annual revenue, and employment numbers. This journal also provided useful information on the general Dallas business climate.

The *Greater Dallas Office Guide* for Summer/Fall 1995-1996 provided information on many aspects of local office activities. This annual publication from the Greater Dallas Chamber, similar to the *Business and Industry Journal*, is designed to provide pertinent information for those corporations and businesses considering moving to the Dallas area. The guide provides an overview of the business climate, plus an in-depth listing of all office building properties in the Office Buildings Guide section. This

section divides the Dallas area into eleven "sub-market" sectors. Information is provided on each office building within individual sectors, including: location, building name and address, leasing company, year built and renovated, rent, stories and floor size, and total square footage and total available. This journal was mainly used to compile office space data.

Private sector sources also proved to be valuable in the data collection process. These were useful in verifying statistical information extracted from Dallas Chamber publications. The CB Commercial Real Estate Group, Inc and *Black's Commercial Real Estate Guide* both provided information on office real estate activities similar to the aforementioned sources. The CB Commercial provided *Update '95*, a yearly publication on the office real estate market. Black's publication is similar to the Dallas Chamber Office Guide. *Site Selection* magazine and *National Real Estate Investor* magazine are national industry-specific monthly publications. These sources were used to gather more information on office activities and also contained some historical background on the Dallas area. Time and financial constraints limited contacting more real estate groups.

Methodology

The overall concept of this study is to produce a profile of service sector activities in a highly decentralized metropolis. To accomplish this task, firms are located, data sets are analyzed through statistical analysis, and results are then qualitatively analyzed to produce inferential

conclusions. Variables used in this study were determined according to the common definition of the producer services and were then matched to the available data.

Data Analysis

Analysis of producer services includes three categories: Finance, insurance, and real estate; Business services; and Professional services (Table 6). The service industries and all firms used in analysis were extracted from the *Dallas Business and Industry Journal*. For each industry, the 20 largest firms are included, ranging in most cases from several thousand employees to under 50. In some cases, less than 20 firms are listed primarily because the journal was unable to form a complete list. On the contrary, one industry will contain 21 firms because two firms were tied for 20th with the same number of employees. As a result, 225 service firms are used for the purpose of analysis. These firms are distributed among the 12 service industries shown in Table 6. The industries are then subdivided into their appropriate category. Throughout the analysis, these firms will be listed by rank number, when necessary. For reference, full names and addresses are listed in Appendix A.

Initially, firms had to be located in the study area as accurately as possible. First, digitized TIGER/Line file maps of the Dallas area were converted and imported into ATLAS*GIS, a computerized geographic information system. Once the street map was complete, each firm was address-matched to its corresponding address in the map file. For many

FUNCTION
Finance, Insurance, Real Estate
Financial Services
Banks and Savings & Loans
Insurance
Commercial Real Estate
Residential Real Estate
Business Services
Advertising
Property Management
Printing and Publishing
Professional Services
Legal
Accounting
Architectural and Engineering
Health Maintenance

Table 6: Study Categories, Producer Services Industries

firms, no local street address was listed. Attempts were then made to determine those addresses. Those that remained undetermined (a total of eight) were then removed from the data base. Once maps for each of the 12 industries were completed, statistical analysis could begin.

By visual inspection, it was apparent which types of industry clustered. Qualitative analysis can be, and often is, complemented by some means of descriptive statistics. To test visual patterns for significant

clustering, a Nearest Neighbor Analysis was performed. This test is a common procedure for determining the spatial arrangement of a pattern of points, within a study area. It is ideal for the investigation of urban economic functions (McGrew and Monroe, 1993) The nearest neighbor (*NN*) is determined as the closest point in straight-line (Euclidean) distance. For each map, the nearest neighbor distance (*NND*) for each firm was measured in miles, to the fourth decimal place using the distance function in ATLAS*GIS. From each set of nearest neighbor distances, the *average* nearest neighbor distance ($\overline{NND}$) is determined by using the formula for the mean:

$$\overline{NND} = \frac{\sum NND}{n} \qquad (2)$$

where: n = number of points

With the null hypothesis stating that firms are arranged in a random spatial pattern, the expected random nearest neighbor distance is calculated with the formula:

$$\overline{NND}_R = \frac{1}{2\sqrt{Density}} \qquad (3)$$

where: $\overline{NND}_R$ = random average nearest neighbor distance

Density = number of points (n)/Area

The formula was applied, and the spatial arrangement for each service industry map was determined. In addition to its use as a descriptive index of point spacing, nearest neighbor methodology can be used to infer results from the sample to the population from which the sample was drawn (McGrew and Monroe, 1993). A difference test can be used to determine if the observed nearest neighbor index ($\overline{NND}$) differs significantly from the theoretical norm ($\overline{NND}_R$) which would occur if the points were randomly distributed. This statistic (Z_n) is calculated:

$$Z_n = \frac{\overline{NND} - \overline{NND}_R}{\sigma_{\overline{NND}}} \qquad (4)$$

where: $\sigma_{\overline{NND}}$ = standard error of the mean

The standard error for the test is estimated with the formula:

$$\sigma_{\overline{NND}} = \frac{0.26136}{\sqrt{n(Density)}} \qquad (5)$$

A negative Z-value indicates a tendency to cluster. A Z-value of 0 indicates random distribution while a positive value indicates an evenly dispersed pattern. Finally, degree of significance was determined for each industry using P-values.

To test the null hypothesis that firm size is not related to location in the CBD or outside the CBD, a Wilcoxon Rank Sum test was performed. The Wilcoxon rank sum test uses ratio data downgraded to an ordinal

(ranked) equivalent (McGrew and Monroe, 1993) and is appropriate for use in employment rank size testing. Two samples, "In-CBD" and "Out-CBD," are used in this case. The test statistic for the two sample Wilcoxon procedure is:

$$Z_W = \frac{W_i - \overline{W}_i}{S_w} \qquad (6)$$

where: W_i = sum of ranks of sample *I*

$\overline{W}_i$ = mean of W_i

$$= n_i \left(\frac{n_1 + n_2 + 1}{2}\right) \qquad (7)$$

S_w = standard deviation of W

$$= \sqrt{n_1 n_2 \left(\frac{n_1 + n_2 + 1}{12}\right)} \qquad (8)$$

Upon completion of the statistic for each industry type, results could then be analyzed for patterns of location related to firm size. A negative Z-value means that larger firms tend to be located in the CBD, while a positive value indicates that larger firms tend to be located outside the CBD. P-values were also calculated to test for significance.

Thesis Organization

The remaining three chapters will detail the analysis and results of testing the hypotheses of this study. Chapter III will give a brief historical

perspective of the economic evolution of the city of Dallas and its surrounding suburbs. Chapter IV describes the locational analysis and results in two segments. The first segment will cover details of the agglomeration of service activities according to the results of the nearest neighbor analysis. The second segment will discuss findings of the locational tendencies of large firms via the Wilcoxon rank sum statistic. Chapter V will be a general summary of the study. Included in this chapter will be discussion concerning the conclusions and limitations of the research followed by recommendations for further research.

CHAPTER III

HISTORY AND DEVELOPMENT

Economic History of Dallas

In the late nineteenth century, cotton was king of the economy in the city of Dallas. It seemed that nothing was better suited for the area's rich blackland soil. When the railroad came to town, Dallas became an important distribution hub. In 1894, the international market became reality when telegraph technology plugged the city into a real-time global cotton pricing environment. For the next fifty years, the cotton trade remained important to the Dallas economy. The local manufacturing industry kept pace by developing sophisticated cotton ginning and chopping machinery which was distributed around the world (*Business and Industry*, 1995).

Cotton, however, eventually gave way to an astounding discovery that would change the Dallas economy forever. On January 10, 1901, a driller struck oil in a field near Beaumont, Texas. It was soon discovered that Texas possessed more oil reserves than the rest of the country combined. Soon after, Oklahoma, Arkansas, Louisiana, and Kansas began to draw oil from the ground and Dallas became the petroleum hub of the mid-continent area. Dallas left the petroleum refining dirty work to other cities, such as

Houston, and opted to serve instead as a center for related services, equipment, and finance. By the end of the 1930s, nearly 300 local firms were engaged in the oil industry in such capacities as operators, lease brokers, royalty owners, geophysicists, and drilling contractors (*Business and Industry*, 1995).

In the years that followed, the United States became involved in World War II. The day after the attack on Pearl Harbor, local police entered the Cotton Exchange to arrest three Japanese brokers. Soon after, the entire country was thrust into war goods production. Dallas had been preparing for such production since 1940, when North American Aviation of Inglewood, California announced that it would engage in an ambitious development billed as "the greatest industrial development effort in the history of Texas." North American then built a $7 million state-of-the-art aircraft plant just south of Dallas that would employ more than 30,000 local workers before the end of the war (*Business and Industry*, 1995).

Dallas area workers earned many War Department "E" awards for shattering production quotas and time schedules on the way to building a national reputation for having the best skilled work force in the country. Finally, city boosters had documentation proving their boasts of a solid work ethic. This helped Dallas land its first major corporate relocation, a precursor of what eventually would become the standard. In the largest industrial relocation in American history, aviation mogul Chance Vought moved his enormous factory in Connecticut by rail to Dallas in 1948. Chance Vought Aircraft, under the financial creativity of James Ling, was

later reborn as LTV, and again as Vought Aircraft as it undertook design and production of new military weapons systems (*Business and Industry*, 1995).

For years afterward, Dallas was widely acclaimed in the national media. Dallas' popular image was growing. The song "Big D" was popular on Broadway, and Gary Cooper played a federal marshal in the movie "Dallas." The city was awarded a future world famous professional football team. As popularity grew, word spread in corporate circles of the advantages the city had to offer. Dallas boasted economic accessibility to regional, national, and international markets; a high quality of life and affordable housing; mild winters; and a distinctive local work ethic (*Business and Industry*, 1995).

As a result, Dallas has since attracted many high profile corporations. General Motors constructed a $35 million assembly plant in Arlington, for example. Corporate headquarters relocations expanded the city's economic base. These included Dresser Industries, J.C. Penney, Frito-Lay, Dr. Pepper, Mary Kay Cosmetics, Exxon, and American Airlines, among others. Locally grown technology has also fueled Dallas' economy. In 1958, an engineer at Texas Instruments developed the integrated circuit, a device that rivals the wheel in its impact upon humankind (*Business and Industry*, 1995).

The 1970s were an era when service sector activities began to grow in the local, as well as the national, economy. By the 1980s, the presence of oil lifted Dallas' banking and financing environment to the forefront of

the national scene. Dallas' insurance industry, which earned the city the title of "the Hartford of the Southwest," grew in response to the rapid business and population growth. Advertising and publishing companies also flourished in this environment (*Business and Industry*, 1995).

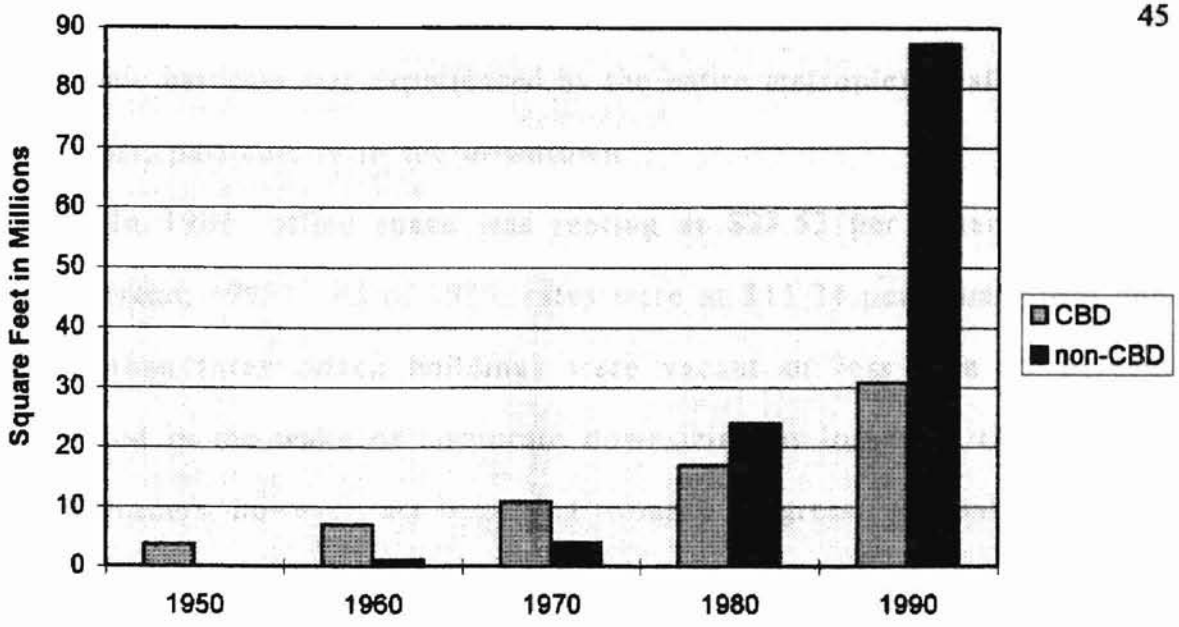
The "Financial Capital of the Southwest" also developed a quite large demand for accounting and legal services. Consequently, many accounting and legal firms with solid national reputations are headquartered in Dallas. Both commercial and residential real estate markets enjoyed phenomenal growth during the 1980s. The city enjoyed one of the most impressive real estate booms in modern history, one which catered to the development of an extensive architectural, contracting, and construction labor pool. In 1985 alone, 123 multi-tenant office projects totaling more than 16.42 million square feet came on line (*Business and Industry*, 1995).

Office Activity Development

The Central Business District

During World War II, a time when many large cities fell into economic strife, Dallas continued to boast a strong economy. At the foundation of that strength was the central business district. Immediately after the war, it was thought that the CBD's strength and vitality would not immediately change. The prevailing attitude was that downtown Dallas exuded prestige.

In 1950, the CBD contained all office activity in the area (Figure 9).



Data source: *Dallas Office Guide*, 1995

Figure 9: Office Inventory by Decade, 1950-1990

Office activity can be described as including all established office functions and those office buildings under construction at any given time. By 1960, the office inventory downtown stood at approximately eight million square feet. Growth was slow but steady through the 1960s, with little change until the early 1980s. The beginning of the decade brought with it national economic prosperity; oil prices were rising, and expansion was the rule. The amount of office space in downtown almost doubled by 1985 as one building project after another was completed, but with no guarantee of occupation.

As the 1980s came to a close, the economic boom began to crumble. When oil prices fell, the banking industry suffered as endless numbers of oil and gas businesses began to fail. As a result, the commercial real estate market stagnated, with millions of square feet remaining empty. While

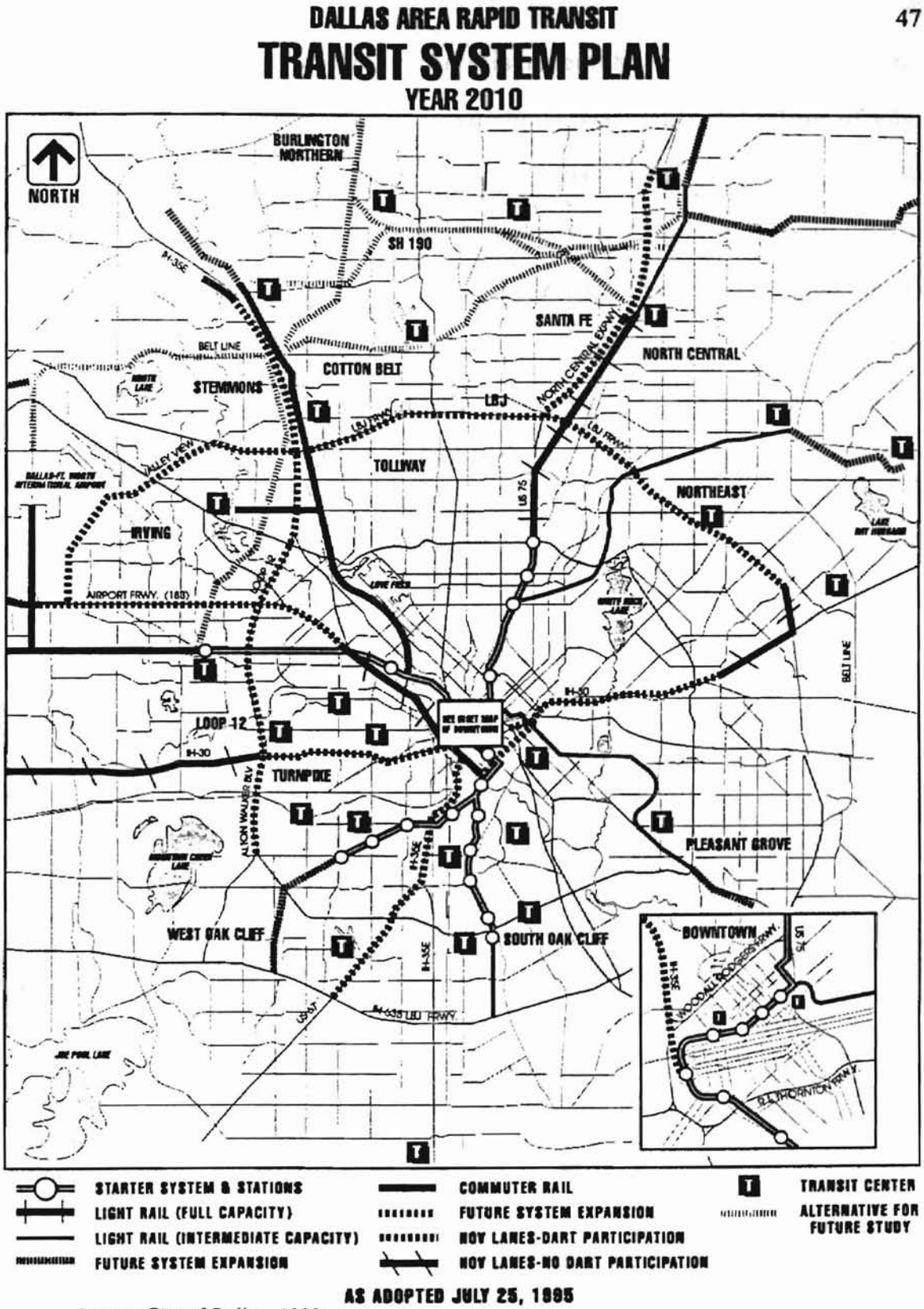
economic hardship was experienced by the entire metroplex, Dallas suffered the most, particularly in the downtown.

In 1986, office space was renting at $23.52 per square foot (CB Commercial, 1995). As of 1995, rates were at $11.74 per square foot and more than three dozen buildings were vacant or less than 25 percent occupied in the wake of corporate downsizing or losses to the suburbs. Local leaders, however, are beginning to make progress. Special taxes have increased downtown police protection to reduce crime. Perhaps the most anticipated project is the Dallas Area Rapid Transit (DART) public transit system (Figure 10), which is expected to boost downtown activities.

The Metroplex

Construction outside the CBD first began in 1952. Marking the beginning of the era of decentralization in Dallas, the twelve-story American General building rose immediately to the north of the Woodall Rodgers Freeway (see figure 8). By 1960, just over one million square feet had been constructed to the north of the CBD, an area appropriately referred to early on as the "Uptown." Office activity elsewhere in the metroplex began to accelerate during the 1970s, and by 1980, non-CBD inventory accounted for the majority of office space (see figure 9). Building expansion outside the CBD more than tripled before 1990 (*Dallas Office Guide, 1995*).

In his book, *Edge City* (1991), Garreau identifies seven edge cities in the Dallas area. All are in the northern portion of the metroplex,



Source: *City of Dallas, 1995*

Figure 10: Light Rail System, Downtown Dallas

roughly the same area of study for this research. Figure 11 shows that portion of the metroplex. This map combines Garreau's definition of edge cities (see page 7) and information in the Dallas Office Guide to show the location of each edge city and its approximate square footage. The proportional circles do not necessarily represent the spatial extent of the edge cities, which tend to elongate as a result of interstate highway dependency. The map is only intended to visually orient the reader to the general location of each office node (edge city) and the approximate amount of office space in each.

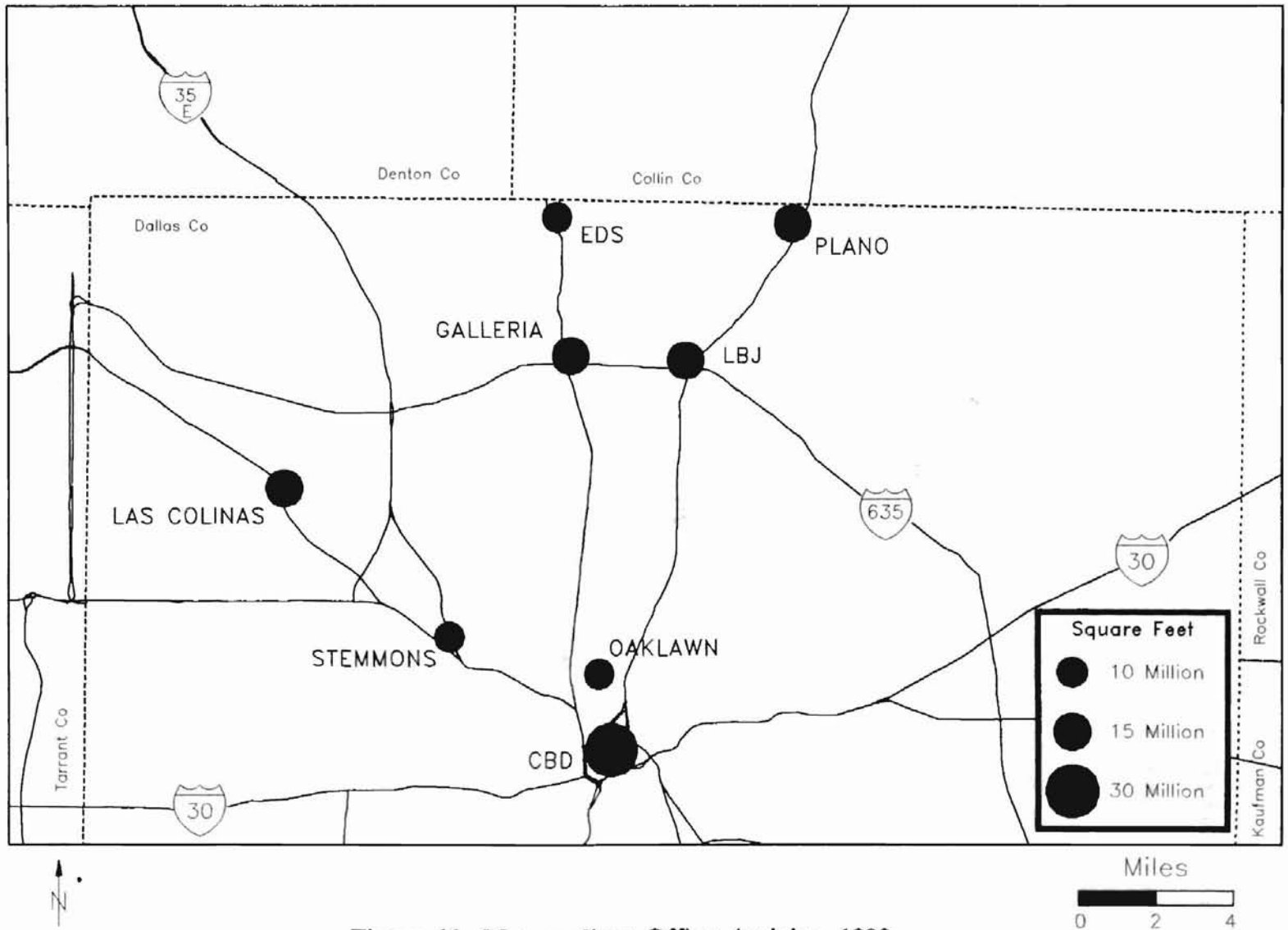


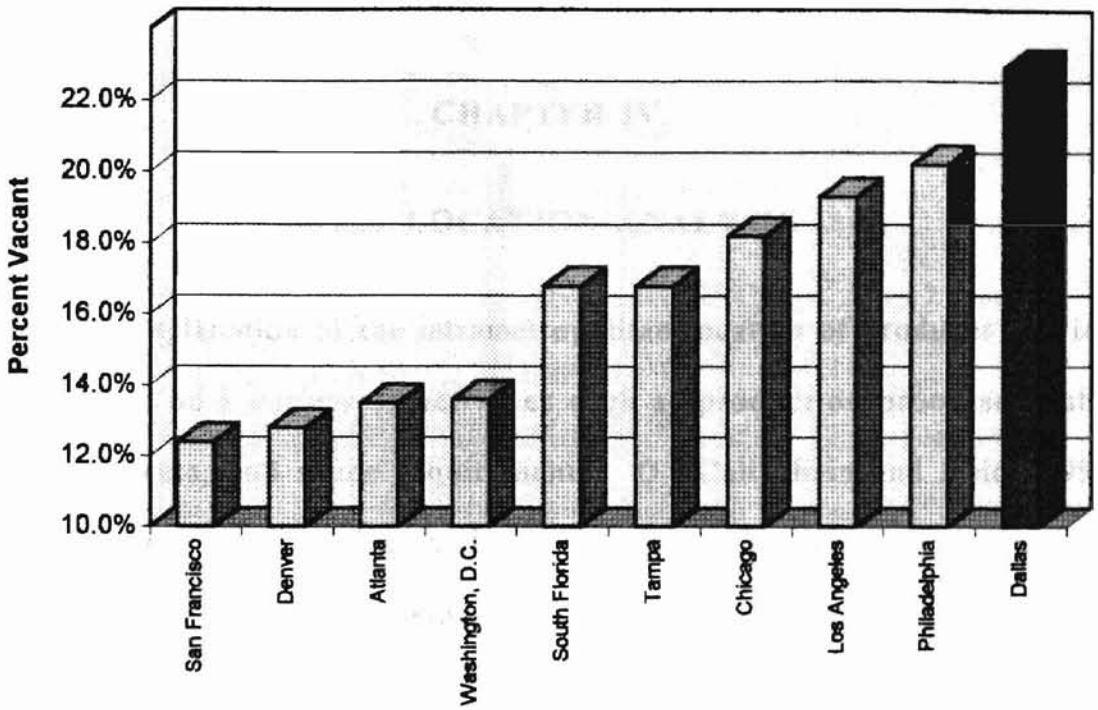
Figure 11: Metropolitan Office Activity, 1990

Summary

From its beginnings as a cotton production center, Dallas has made the most of each new challenge. Dallas has, like many American cities, endured the ravages of wholesale suburbanization and economic restructuring. However, it has developed into a leading city on the economic cutting edge of America. Crude oil thrust it into the national spotlight as it took advantage of its expanding economic base. This era was the forerunner to its emergence as a regional financial and services center. The city's future will continue to brighten if it can overcome the lingering effects of the economic recession of the early 1990s.

Its extensive office inventory reflects economic vibrance, but it also reflects some weakness. The prevalence of speculative office construction in the 1980s, in which buildings were raised without any commitment from prospective tenants, left an enduring mark: an overall metropolitan office vacancy rate that is the highest among large cities (Figure 12) in the nation. However, forecasted business growth and revamped construction practices will remedy this problem. Office buildings are now built-to-suit for committed clients. As a result, office occupancy grew by more than half a million square feet in 1994 after several years of decline.

In the future, nearly two-thirds of the region's growth is expected to come in the service and trade sectors. Business services now make up 30% of the service jobs in the Dallas area and will account for 40% of the service sector's employment growth (*Business and Industry*, 1995). The



Source: *Business and Industry*, 1995

Figure 12: National Comparison of Office Vacancy

finance, insurance, and real estate sector is on the upswing, and commercial banks are again profitable. The recent passage of the North American Free Trade Agreement (NAFTA) between the United States, Canada, and Mexico promises to further strengthen the area's presence in both the international and local economies as well as its place on the list of preferred cities for corporate expansions and relocations (*Business and Industry*, 1995). The financial and general economic woes of the late 1980s brought economic recession, followed by slow economic recovery in recent years. However, Dallas' economy has not only survived, but has strengthened in the face of a bright future.

CHAPTER IV

FIRM LOCATION ANALYSIS

The explanation of the intrametropolitan location of producer services is dependent on a variety of activities such as production processes, labor needs, markets, and space requirements. O hUallachain and Reid (1992) found that legal, advertising, and accounting services are most centralized in the Phoenix area. Accessibility to customers dictated the location of most for-profit health and personal services because services relying on final demand markets are most likely distributed within a metropolitan area in a manner similar to the population.

Analysis of the corporate control activities (headquarters) of finance, insurance, and real estate (FIRE) industries is consistently conducted in aggregate form (Ettlinger and Clay, 1991). While the subjects of my research are generally corporate headquarters, a slightly different approach is taken by disaggregating FIRE. In this chapter, discussion will be initially directed toward the CBD. This will be followed by results of the service industry cluster analysis. Discussion will then turn to results of the size vs. location analysis. The edge cities shown in figure 11 on page 47 will be used as points of reference during discussion of the analyses in the following sections.

Agglomeration of Activities

This analysis focuses on determining which services are predominantly located in the CBD. Results indicate that financial, legal, and accounting services are the most centralized. Health maintenance, printing, and residential real estate are absent from the CBD. Table 7 shows the locational tendencies among the sample population services.

From the table, FIRE services show only modest representation in the CBD. Of these, only financial services are mainly located in the downtown (55%). Sizable proportions of insurance and banking services were also found downtown. Very little real estate activity was found in the CBD. Business services generally appear to be dispersed outside the CBD. Of these, only property management shows modest activity (26.3%). Professional services are the most aggregated in the CBD. Of the professional services, legal activities are the most highly centralized (90%), with accounting being the next highest (60%). Although it is clear that the CBD no longer proportionally dominates all services, it does retain a substantial portion of specialized functions.

While this information gives insight into the proportions of service industries in the CBD, one can investigate locational variations more closely by examining maps of selected services and through the use of descriptive statistics. The limited extent of the study area (see figure 7, page 30), shows that services cluster only in the northern portion of the metroplex. Discussion herein will be limited to variations within the study area.

FUNCTION	Percent Firms in CBD
Finance, Insurance, Real Estate	28.4
Financial Services	55.0
Insurance	43.8
Banks and Savings & Loans	33.3
Commercial Real Estate	10.0
Residential Real Estate	0
Business Services	12.3
Property Management	26.3
Advertising	10.5
Printing and Publishing	0
Professional Services	40.0
Legal	90.0
Accounting	60.0
Architectural and Engineering	10.0
Health Maintenance	0

Table 7: CBD Proportions of Service Industry Firms in Dallas, Texas

Clustering occurs both inside and outside the CBD. In Table 8, industries are ranked by a nearest neighbor-based z-statistic from most to least clustered; p-values range from zero to .2743. Significant clustering is evident at the $\alpha = .01$ confidence level in all but insurance (.1423) and printing and publishing (.2743). Table 8 is abbreviated; a complete table of statistical results for each industry is included in Appendix B. It was

FUNCTION	Z-value	P-value
Finance, Insurance, Real Estate	-3.5890	
Commercial Real Estate	-5.7208	0
Financial Services	-5.2830	0
Banks and Savings & Loans	-3.4945	0.0002
Residential Real Estate	-2.3738	0.0089
Insurance	-1.0730	0.1423
Business Services	-2.8401	
Advertising	-4.3771	0
Property Management	-3.5466	0.0002
Printing and Publishing	-0.5966	0.2743
Professional Services	-5.9149	
Legal	-8.4866	0
Accounting	-6.8833	0
Health Maintenance	-5.2740	0
Architectural and Engineering	-3.0158	0.0013

Table 8: Cluster Analysis Results for Service Industries

interesting to see commercial real estate with a high degree of clustering. The significant clustering of law firms was not a surprise; however, that of health maintenance organizations was. Professional services, as a whole, are the most concentrated (-5.9149).

Figures 13 through 16 show the locational patterns of selected service industry firms in the north Dallas study area. Figure 13 shows accounting

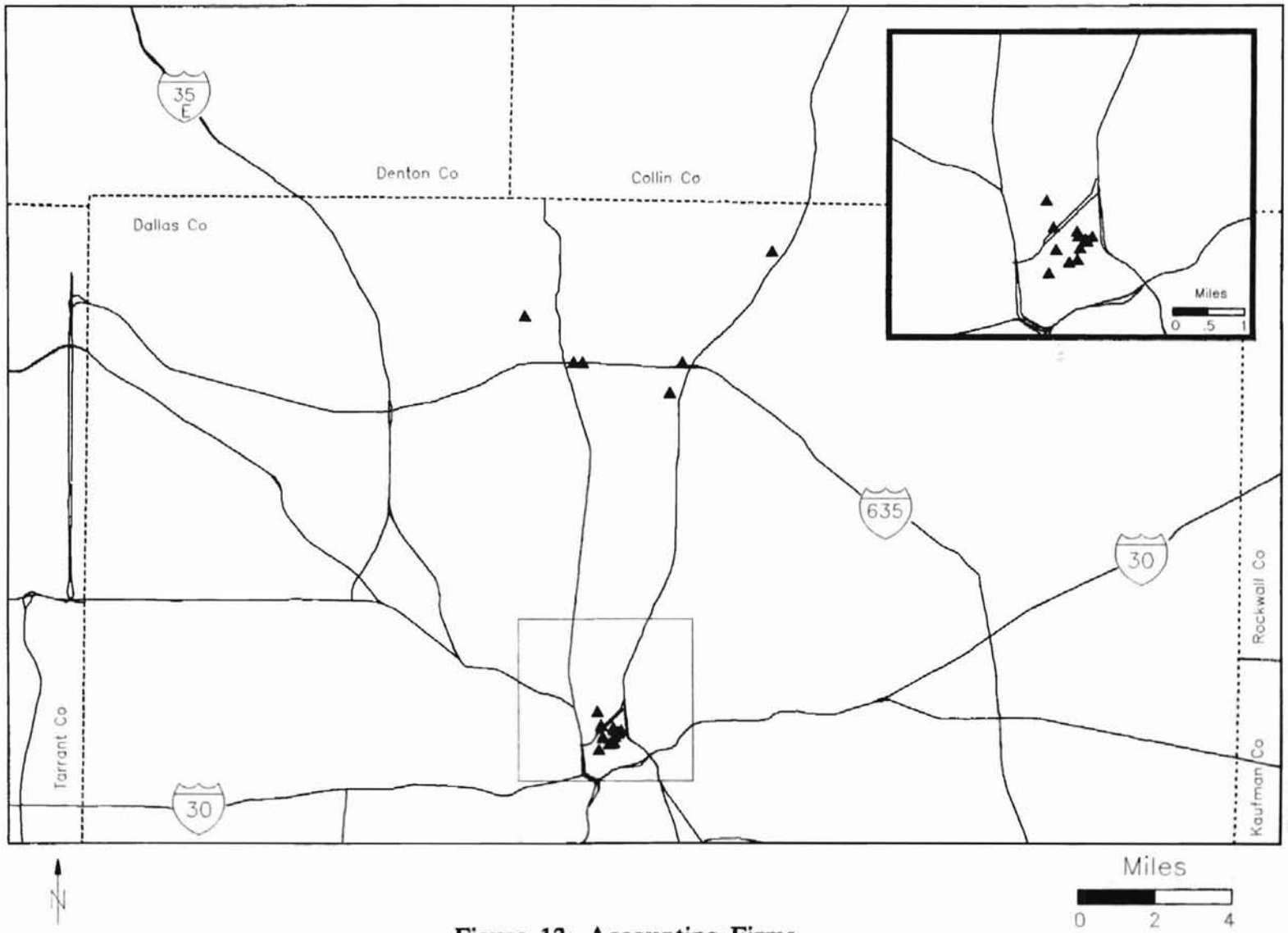


Figure 13: Accounting Firms

firm locations. Two clusters are readily noticeable: the primary cluster, located downtown, and a secondary cluster located in the Galleria/LBJ edge city area. This clustering in the downtown can be attributed to a need for face-to-face client contact. O'Hara (1977) argued that downtown services that select a central location do so in order to minimize transportation costs associated with the face-to-face interaction between themselves and their customers. The secondary cluster is more subjective, however. Helsley (1990) argued that location in the suburbs implies that the advantage of lower land costs outweighs the drawbacks of separation from the information flows in central city networks.

Another industry of note is that of law firms (Figure 14). These firms are, by far, the most spatially concentrated. With the exception of two firms that share the same address, all are located in the CBD. They are apparently dependent on the standard benefits of central location: accessibility to the entire metropolis, face-to-face client contact, and perhaps the atmosphere of prestige reminiscent of most large downtowns.

Figure 15 shows the distribution of financial services firms. It is immediately noticeable that these firms are clustered in the central business district while a few are scattered along major interstate highways in the Las Colinas and LBJ areas. It appears that most financial service firms prefer to locate in the CBD, again, the one place in all large cities that remains heavily dependent on face-to-face contact between the firms and their clients.

Another interesting pattern can be seen with commercial real estate

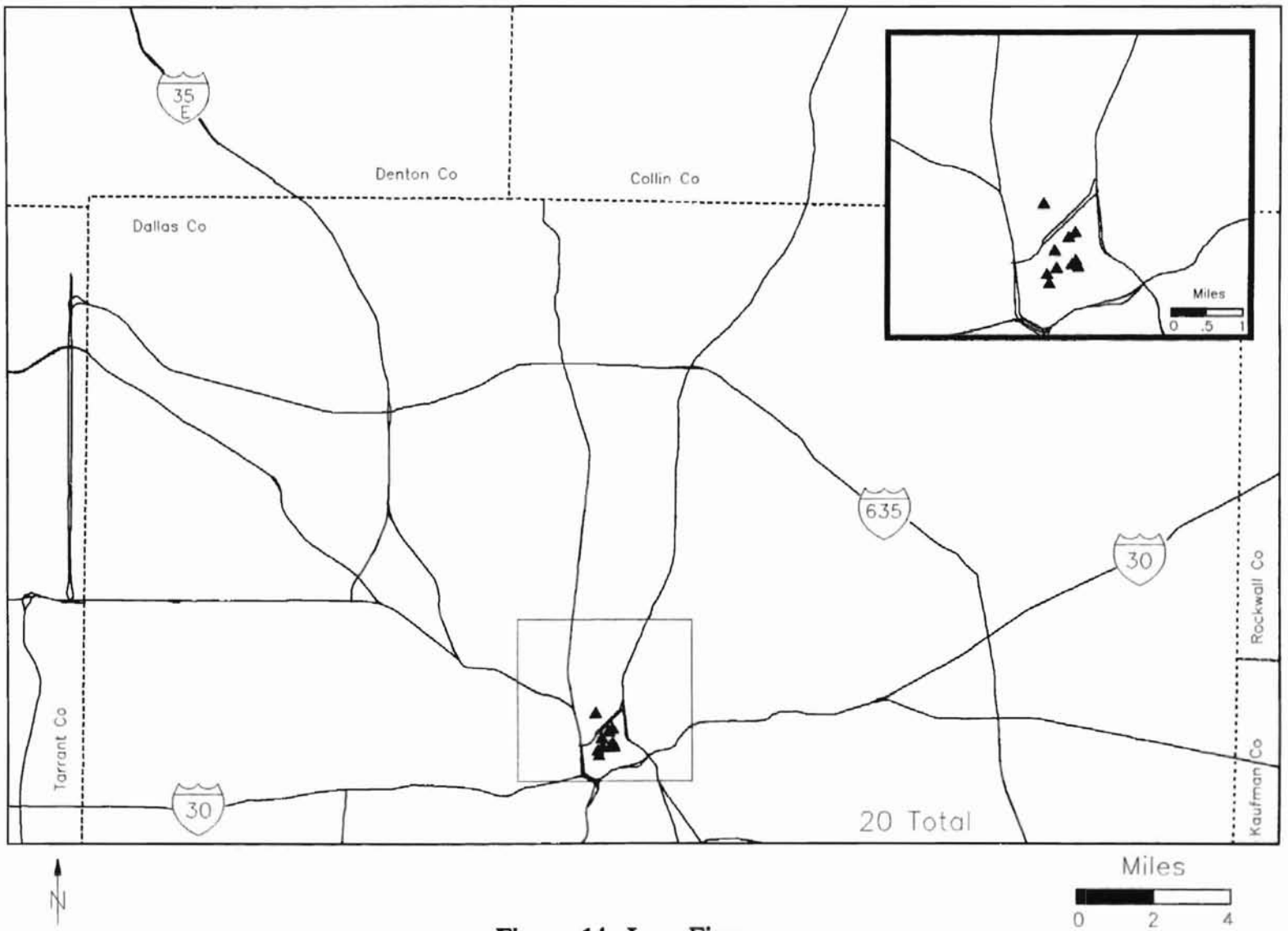


Figure 14: Law Firms

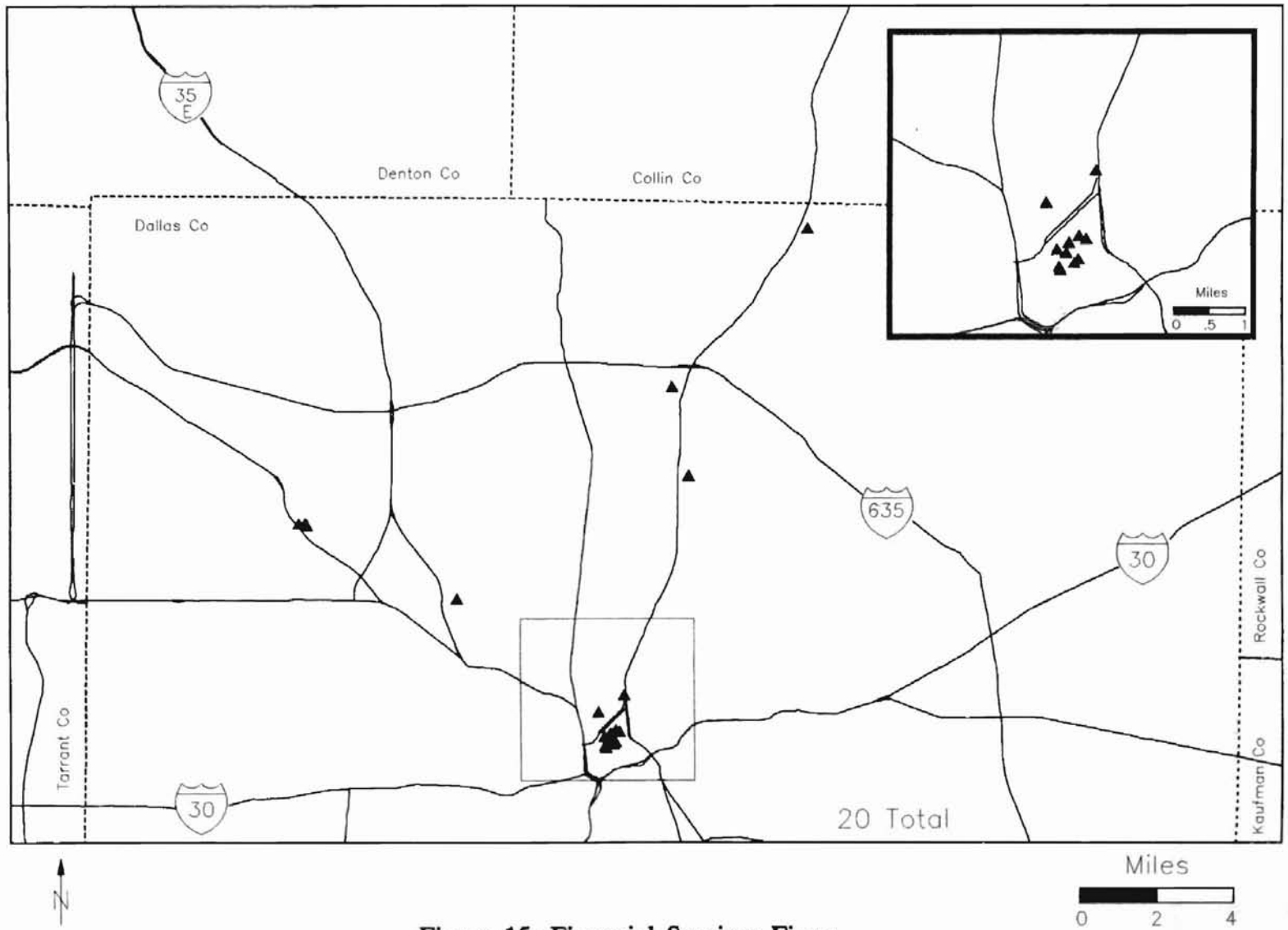


Figure 15: Financial Services Firms

firms (Figure 16). With the exception of the outliers, the primary cluster is located in the Galleria/LBJ office area while the secondary cluster is located near Oaklawn/CBD offices. Since these firms engage in the buying and selling of office real estate, it is not surprising to find them in the vicinity of large office nuclei. This industry can be classified as one relying on a final demand, consumer-driven market.

These examples support the existence of clustering in some industries, rather than random dispersal. Although this is not a pattern found in all industries, professional services cluster more than others, both inside and outside the CBD. This supports the the conclusion that high order, specialized services are not ubiquitous, especially when compared with FIRE and business services.

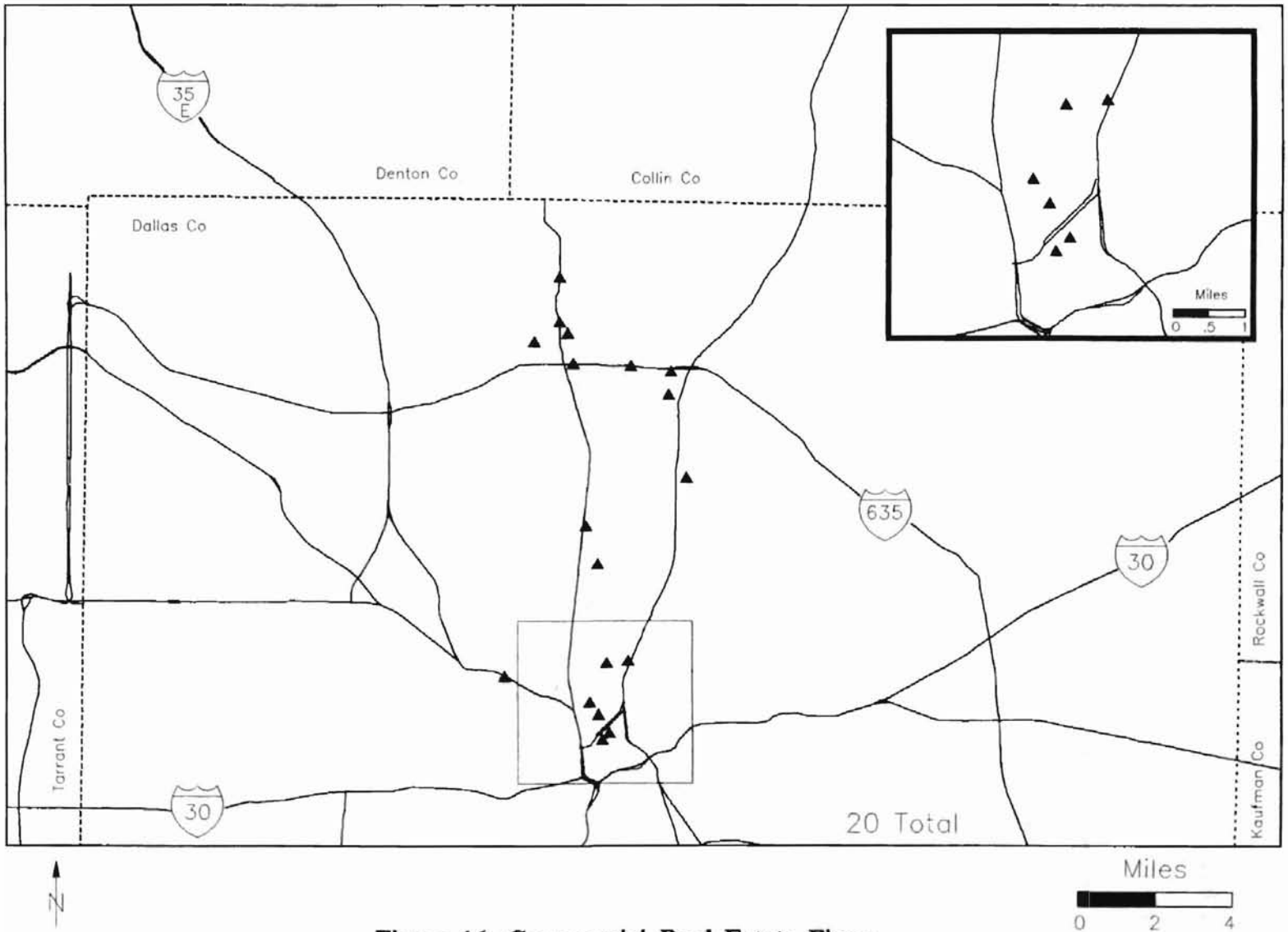


Figure 16: Commercial Real Estate Firms

Firm Size and Location

The alternate hypothesis that firm (employment) size is related to a particular location was tested by the Wilcoxon rank-sum statistic. Do large corporate headquarters prefer the downtown over other areas in the metroplex? This research has revealed such a pattern exists for some services, more than others. Table 9 shows the rank-sum results. Industries are ranked according to z-statistic. Negative values indicate large firms cluster in the CBD while positive values indicate only small firms in the CBD, and absence of z-statistic indicates absence of firms in CBD.

P-values are significant at the $\alpha = .05$ level with the exception of four industries: commercial real estate (.1292), advertising (.1446), financial services (.0793), and architectural and engineering (.0505). According to Table 9, banks, property management, and accounting industries are at the tops of their respective categories. Once again, professional services are the overall average winner (-1.41). Complete statistical results for these and other industries are listed in Appendix B.

Accounting, banking, and property management industries exhibit varying degrees of large firms locating downtown. Figure 17 shows the distribution and size-rank of property management firms. In this case, half of the top 10 are located in the CBD. The rest seem to be randomly dispersed around the study area. Banks and Savings & Loans exhibit similar behavior (Figure 18). This can be attributed to two points. First, the largest banks may have more branch facilities than smaller banks,

FUNCTION	Z-value	P-value
Finance, Insurance, Real Estate	0.08	
Banks and Savings & Loans	-2.15	0.0158
Commercial Real Estate	-1.13	0.1292
Financial Services	1.41	0.0793
Insurance	2.28	0.0113
Residential Real Estate	0	------
Business Services	-1.19	
Property Management	-2.31	0.0104
Advertising	-1.06	0.1446
Printing and Publishing	0	------
Professional Services	-1.41	
Accounting	-2.24	0.0125
Legal	-1.76	0.0392
Architectural and Engineering	-1.64	0.0505
Health Maintenance	0	-------

Table 9: Results of Rank Statistic for Service Industries

thus allowing them to more easily centralize their control centers. The fourth largest bank in Las Colinas is the exception. Second, the larger banks may be attracted to the sense of prestige that is generally associated with most large downtowns.

This argument is more strongly supported by the distribution of accounting firms in Figure 19. As discussed earlier, accounting firms are

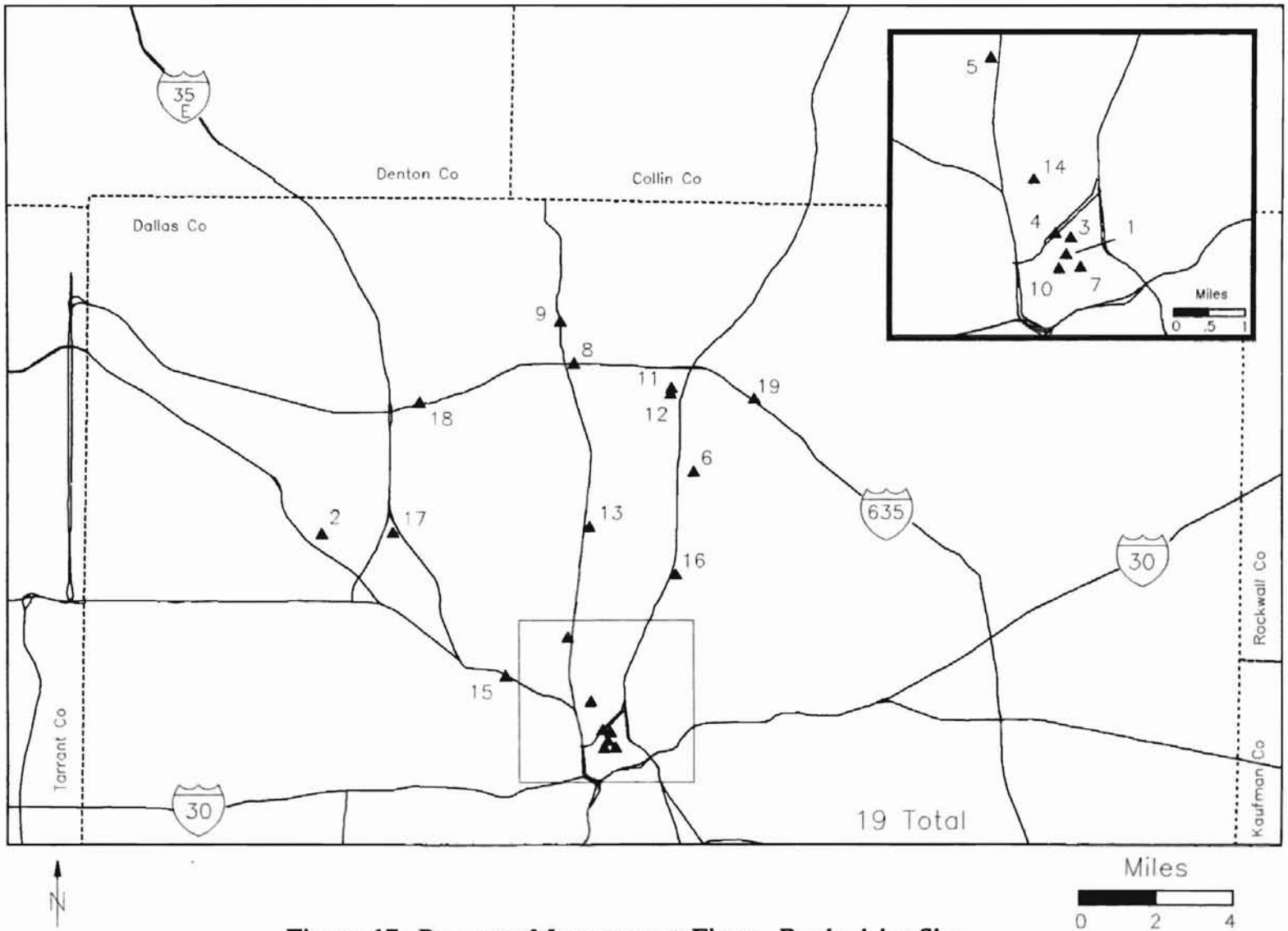


Figure 17: Property Management Firms, Ranked by Size

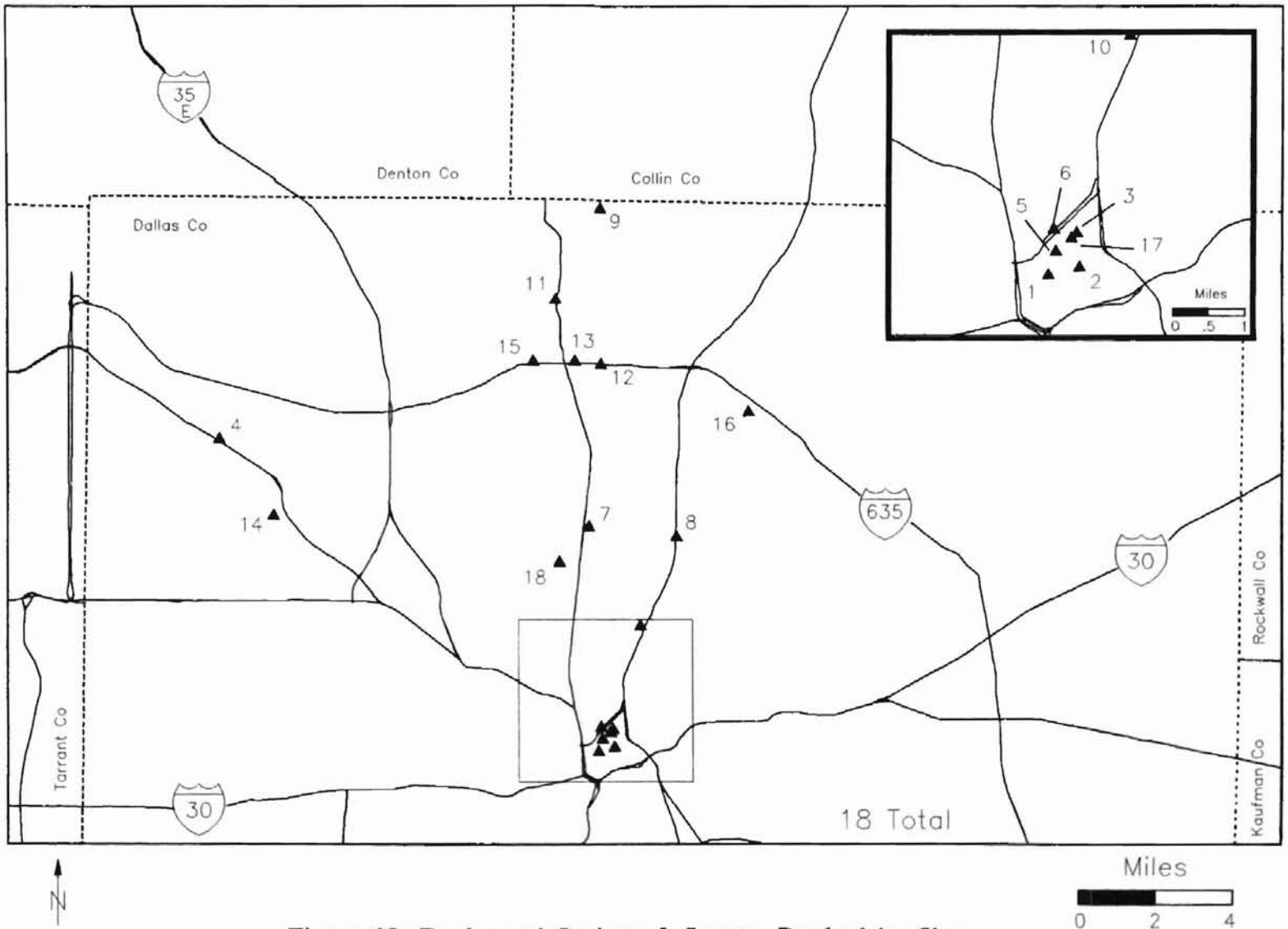


Figure 18: Banks and Savings & Loans, Ranked by Size

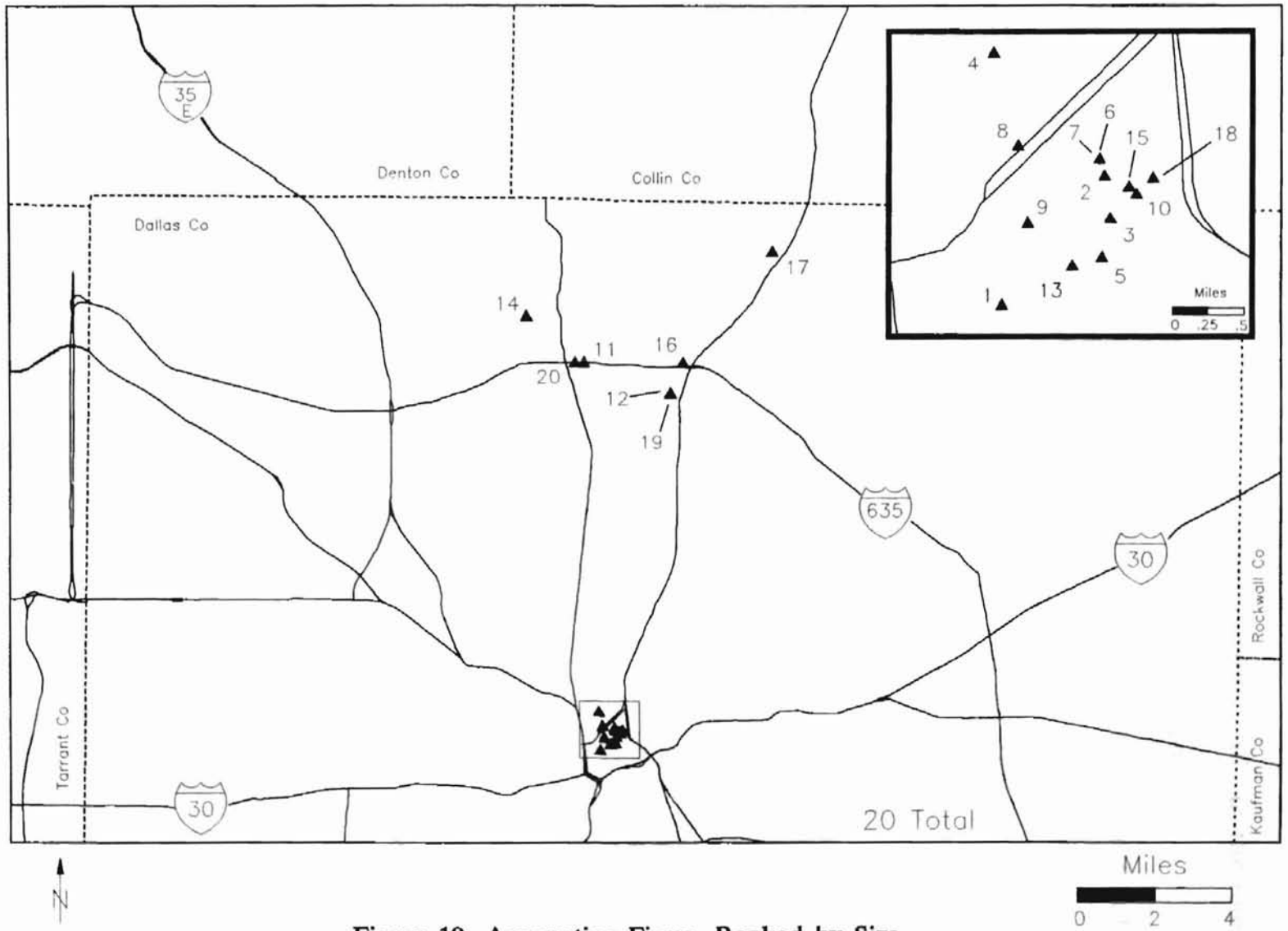


Figure 19: Accounting Firms, Ranked by Size

highly concentrated in the CBD. The vast majority of those in the downtown are comparatively larger than those outside. All but the fourth largest accounting firm are located inside the CBD's boundary.

Further evidence of large firms' preference of the CBD is offered in Table 10. Firms in each industry have been separated according to location (In-CBD, Out-CBD). Given that each firm is ranked according to its size,

FUNCTION	AVERAGE RANK In-CBD	Out-CBD
Finance, Insurance, Real Estate		
Financial Services	12.0	8.5
Insurance	11.5	6.0
Banks and Savings & Loans	5.5	11.5
Commercial Real Estate	6.0	11.0
Residential Real Estate	-----	8.0
Average Rank	8.8	9.0
Business Services		
Property Management	4.0	11.5
Advertising	6.0	10.5
Printing and Publishing	------	9.0
Average Rank	5.0	10.3
Professional Services		
Legal	9.5	17.5
Accounting	8.0	14.0
Architectural and Engineering	4.0	11.0
Health Maintenance	-------	10.0
Average Rank	7.2	13.1
Overall Rank	7.0	10.8

Table 10: Average Service Firm Rank by Size

(the larger the firm, the lower the number; e.g.: largest = 1) the *average* firm rank, both inside and outside the CBD, can be calculated for each industry. The averages for each service category are also shown.

The Overall Rank numbers indicate the CBD has a larger average firm size (7.0) when compared to those firms outside the CBD (10.8). Thus, it appears that large firms, on average, still prefer a downtown location despite the centrifugal effects of decentralization.

Summary

Today, the Dallas CBD serves as a high order, specialized services center. As expected, professional services were found to be the most concentrated in the CBD. Business services were the least centralized. It is clear that the financial strength of the CBD has weakened considerably since World War II. According to the number of firms in the CBD, almost half (45%) of financial services activity is decentralized and only a third (33%) of banking activity remains in the downtown.

Large firms were shown to have an affinity for downtown Dallas. This may be because these firms are older and more easily satisfied with their environment than those elsewhere in the metroplex. For them, centrality and prestige are most likely the downtown area's primary advantages.

Contrary to anticipations, service activities located predominantly outside the CBD were found to exhibit limited rather than general clustering. Consumer-oriented business services tend to be ubiquitous

across the study area.

The results of Smith and Selwood's (1983) study are remarkably similar. In the centralized city of Columbus, Ohio, they found that government and professional services were the most centralized while FIRE and business services exhibited a higher level of decentralization. Though O hUallachain and Reid (1992) did not investigate FIRE services, the results of their study of business and professional services in Phoenix were substantially different. They found that advertising, accounting and auditing, and architectural and engineering services are most centralized. Though methodologies differ, these studies show, at the least, that economic activity can vary greatly from city to city.

CHAPTER V

SUMMARY OF RESEARCH

The purpose of this study was to examine the Dallas central business district's current role and relationship with the metropolitan area by studying the distribution of producer services firms. This research has constructed a profile of the present-day distribution and behavior of service activities in a large, decentralized metropolitan area, filling an information void in the body of urban studies literature. However, these findings represent only a few pieces to the much broader mosaic of the American urban landscape.

The Dallas area was chosen because of its extensively decentralized economic functions, a type of urban environment that has consistently received little attention. Moreover, Dallas' economic history has been conducive to the formation of a large, international service economy.

A useful by-product of such a large, diverse economy is the availability of many sources of data. Both public and private publications proved to be of great value in accomplishing the research objectives. The qualitative analysis of this data was effectively complemented by the utilization of the nearest neighbor analysis and the Wilcoxon rank sum descriptive statistic.

Conclusions

For decades, the Dallas area has experienced phenomenal growth accompanied by the wholesale restructuring of the economy. Decentralization has continually challenged downtown Dallas to remain a viable part of the metropolitan structure. It has survived by catering to those services that have committed to remaining centrally located.

This study addressed three interrelated hypotheses:

1) Despite extensive decentralization, financial and professional services are the most centralized, allowing the CBD to retain functional economic importance in the metroplex.
2) Decentralized services cluster rather than disperse in areas outside the CBD.
3) Large service firms tend to locate in the central business district.

According to the results of this study, the first hypothesis was demonstrated to be true. Although representation of financial service firms in the CBD has eroded considerably, the downtown still retains the majority of financial activity. Professional services show a strong presence in the CBD. The second hypothesis, however, was not true. In this case, clustering outside the CBD was evident only in accounting and commercial real estate firms. The rest exhibited a much more dispersed pattern than

expected. The third hypothesis was shown to be essentially true. Overall, large firms prefer to locate in the downtown, apparently taking advantage of its prestige and central location.

What does the future hold for the downtown area? Only time can answer this question. Downtown Dallas must continue to promote its traditional attributes. While nearby edge cities are little more than a workplace destination for the young professional, the CBD offers a more aesthetically and culturally pleasing atmosphere. Fortunately, city leaders have begun to answer this competitive challenge by placing renewed emphasis on public transportation, boosting corporate support for the CBD through financial incentives, and with street level aesthetic enhancements.

According to Chalk (1994), the Dallas area has led the nation in relocation and expansion activity for six consecutive years (1989-1994). Metropolitan office occupancy slowly but steadily rose during that time, but remains low today, especially in the downtown. Commercial real estate leaders must renew their commitments to filling the available office space while holding new construction to a minimum. This particular philosophy is especially important to the success of renewal efforts in the CBD. Most importantly, the efforts of the entire community must become galvanized to ensure the successful future of Dallas' first true economic landmark, it's venerable central business district.

Limitations and Recommendations

This study relies on prevalent theory in its analysis of why service firms locate where they are. In many cases, explanations of distribution had to be generalized. For this reason, a local survey of corporate leaders would have likely been more accurate and appropriate for this type of investigation. Time and financial constraints did not permit the utilization of this tool. Furthermore, an increased sample population may have revealed patterns not easily visible with the limited number of firms used for this study. Further research should seek to use larger data sets, provided the proper data can be located.

Future research should also focus more on investigating smaller units of the service sector at a greater depth. This would be a welcome change in the face of so many services research papers that focus on such a large portion of the national and local economy. Such divisions of labor should be better suited for the enhancement of our knowledge and understanding of the American urban structure.

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APPENDICES

APPENDIX A

SAMPLE POPULATION OF SERVICE FIRMS UTILIZED IN RESEARCH

Table 11:

SAMPLE POPULATION OF SERVICE FIRMS UTILIZED IN RESEARCH

Rank	Name	Local Employment
	Accounting	
1	Arthur Anderson & Co.	1177
2	Ernst & Young	975
3	Coopers & Lybrand	702
4	KPMG Peat Marwick	645
5	Price Waterhouse	633
6	Deloitte & Touche	370
7	Kenneth Leventhal & Co.	141
8	Lane Gorman Trubitt, L.L.P.	100
9	Grant Thornton	70
10	BDO Seidman	52
11	Travis, Wolf & Co., L.L.P.	49
12	Philip Vogel & Co., P.C.	40
13	Martin W. Cohen & Co., P.C.	37
14	Cheshier & Fuller Inc., P.C.	36
15	Belew, Averitt & Co.	35
16	Wallace Sanders & Co.	35
17	Bland, Garvey & Taylor, P.C.	31
18	Tannebaum Bindler & Co., P.C.	30
19	Judd, Thomas, Smith & Co.	27
20	Fisk & Robinson	26
	Advertising	
1	DDB Needham Worldwide Dallas Group	675
2	The Richards Group	240
3	Publicis/Bloom	165
4	Levenson & Hill	82
5	Larkin, Meeder & Schweidel, Inc.	76
6	Moroch and Associates, Inc.	60
7	Berry*Brown Advertising, Inc.	57

Rank	Name	Local Employment
8	Anderson Fischel Thompson	50
9	MBRK Advertising and Public Relations	46
10	Pointe Communications Inc.	43
11	Puskar Gibbon Chapin, Inc.	43
12	Ornelas & Associates	35
13	B.A. Advertising, Inc.	32
14	Ackerman McQueen Inc.	30
15	McKone & Company, Inc.	30
16	Edelman Public Relations Worldwide	26
17	Graze Public Relations	26
18	Saunders Lubinski & White Inc.	26
19	Joiner Rowland Serio Koeppel	20
	Architectural	
1	HKS, Inc.	300
2	Carter & Burgess Inc.	160
3	HDR Inc.	160
4	Halff Associates Inc.	150
5	TPA Inc.	130
6	Huntingdon/Southwestern	127
7	Corgan Associates Architects	110
8	Hellmuth Obata & Kassabaum Inc.	95
9	Huitt-Zollers, Inc.	95
10	Maxim Engineers, Inc.	90
11	Lockwood Greene Engineers, Inc.	80
12	Aguirre Associates, Inc.	75
13	RTKL Associates Inc.	75
14	The Nelson Corporation	62
15	Law Engineering, Inc.	55
16	Wilson and Associates	55
17	Brockette/Davis/Drake, Inc.	54
18	Healthcare Environment Design	53
19	JPJ Architects, Inc.	52
20	Page Southerland Page	50

Rank	Name	Local Employment
	Banks and Savings & Loans	
1	NationsBank	7005
2	Bank One, Texas, NA	4500
3	Texas Commerce Bank	2608
4	Bank of America Texas	1630
5	First Interstate Bank	1000
6	Commerica Bank - Texas	850
7	Guaranty Federal Bank, F.S.B.	802
8	Compass Bank	400
9	Bank United of Texas, FSB	250
10	Bluebonnet Savings Bank FSB	163
11	First Madison Bank F.S.B.	150
12	North Dallas Bank & Trust Co.	125
13	Provident Bank Dallas	125
14	Texas Independent Bank	125
15	Town North National Bank	119
16	BankTEXAS N.A.	100
17	Northern Trust Bank of Texas, N.A.	75
18	Savings of America	75
	Commercial Real Estate	
1	Trammell Crow Company	350
2	Capital Realty Group	150
3	Miller Commercial Realty Group	110
4	Bradford Companies	100
5	CB Commercial Real Estate Group, Inc.	100
6	Cushman & Wakefield of Texas, Inc.	85
7	Grubb & Ellis	80
8	Performance Properties	75
9	The Staubach Company	67
10	The Weitzman Group	52
11	Wilcox Realty Group Inc.	50
12	MEPC American Properties	45
13	Mullen Company	35
14	The Swearingen Company	32

Rank	Name	Local Employment
15	United Commercial Management	30
16	Christon Co. Realtors	27
17	Fults Realty Corporation, AMO	27
18	Marcus Millichap Inc.	25
19	P. O'Brien Montgomery & Co.	25
20	Jackson & Cooksey Inc.	21
	Financial Services	
1	Associates Corporation of North America	3000
2	Fidelity Investments	2500
3	G.E. Capital Services	2000
4	Lomas Financial Corporation	1965
5	Merrill Lynch & Co.	600
6	Smith Barney Inc.	431
7	PaineWebber Inc.	420
8	Principal Financial Securities, Inc.	400
9	Rauscher Pierce Refsnes Inc.	400
10	Southwest Securities Group, Inc.	384
11	IDS Financial Services Inc.	300
12	H.D. Vest Inc.	160
13	A.G. Edwards & Son Inc.	152
14	Bear, Stearns & Co. Inc.	150
15	Dean Witter Reynolds, Inc.	150
16	First Southwest Company	149
17	Prudential Securities, Inc.	125
18	The Equitable/Equico Securities	110
19	Addison Securities, Inc.	70
20	Capital Institutional Services, Inc.	70
	Health Maintenance Organizations	
1	Kaiser Permanente	1400
2	Sanus Texas Health Plan, Inc.	281
3	Prudential Health Care System - North Texas	265
4	HEC Select PPO	233

Rank	Name	Local Employment
5	Anthem Benefit Services, Inc.	200
6	CIGNA of Texas, Inc.	200
7	Aetna Health Plans	150
8	North Texas Healthcare Network	120
9	Planned Behavioral Health Care, Inc. (pbhc)	75
10	MetLife Health Care Network of Texas, Inc.	66
11	United Dental Care Inc.	65
12	American Dental Corp.	45
13	MedicalControl Inc.	45
14	Travelers Health Network of Texas, Inc.	35
15	Private Healthcare Systems, Inc.	32
16	Healthcare Compare Corp.	30
17	PacifiCare	30
18	USA Health Network Company, Inc.	23
19	Vision Service Plan	11
20	Beech Street of Texas	10
21	FIRST HEALTH Strategies of Texas, Inc.	10
	Insurance	
1	Blue Cross & Blue Shield of Texas, Inc.	3260
2	JCPenney Life Insurance Company	1199
3	The Travelers Companies	900
4	Allstate Insurance Company	800
5	Republic Insurance Company	600
6	United American Insurance Company	500
7	American International Companies	400
8	National Group Life Insurance Co.	375
9	Southwestern Life Insurance Co.	350
10	Continental Insurance Company	300
11	Mutual/United of Omaha Insurance	300
12	Allianz Life Insurance Company of North America	275
13	Fireman's Fund Insurance Companies	250
14	Union Bankers Insurance Co.	250
15	Anthem Life Insurance Company	200
16	SAFECO Land Title	175

Rank	Name	Local Employment
	Law	
1	Strasburger & Price, L.L.P.	440
2	Thompson & Knight, P.C.	430
3	Gardere & Wynne	411
4	Locke Purnell Rain Harrell, P.C.	344
5	Johnson & Wortley, P.C.	332
6	Jenkens & Gilchrist P.C.	300
7	Vial, Hamilton, Koch & Knox	294
8	Haynes and Boone L.L.P.	287
9	Jones, Day, Reavis & Pogue	283
10	Winstead, Sechrest & Minick P.C.	280
11	Hughes & Luce, LLP	279
12	Baker & Botts	250
13	Jackson & Walker, L.L.P.	210
14	Cowles & Thompson, P.C.	200
15	Akin, Gump, Strauss, Hauer & Feld, L.L.P.	193
16	Carrington, Coleman, Sloman & Blumenthal, L.L.P.	175
17	Fulbright & Jaworski	170
18	Vinson & Elkins L.L.P.	143
19	Thompson, Coe, Cousines & Irons, L.L.P.	125
20	Munsch, Hardt, Kopf, Harr & Dinan, P.C.	110
	Printing and Publishing	
1	Taylor Publishing Co.	1714
2	Quebecor Printing Dallas	500
3	Williamson Printing Corp.	300
4	Blanks Color Imaging	225
5	American Signature	200
6	Horticultural Printers Inc.	200
7	Treasure Chest Advertising	200
8	Heritage Press	180
9	Clarke American	160
10	Beckett Publications, Inc.	150
11	Dow Jones & Company Inc.	150
12	Buchanan Printing Co.	130

Rank	Name	Local Employment
13	A.J. Bart, Inc.	125
14	Lehigh Press Carrollton	118
15	Bowne of Dallas, Inc.	115
16	Padgett Printing Corporation	110
17	Webworks Inc.	110
	Property Management	
1	Lincoln Property Company	1200
2	JPI	351
3	Trammell Crow Company	350
4	AMRESCO	300
5	Intercity Investments	300
6	Paragon Group	285
7	Prentiss Properties Limited, Inc.	280
8	CB Commercial Real Estate Group, Inc.	180
9	Capital Realty Group	150
10	PREMISYS Real Estate Services, Inc.	150
11	COMPASS Management & Leasing Inc.	110
12	Transwestern Property Company	110
13	Horn-Barlow Co.	103
14	Cencor Realty Services	101
15	Bradford Companies	100
16	Koll/Rubloff Management	100
17	Tonti Properties	100
18	Carter-Crowley Properties Inc.	85
19	Network Management Group, Inc.	75
	Residential Real Estate	
1	Ebby Halliday, Realtors	101
2	Henry S. Miller., Realtors	75
3	Coldwell Banker, Paula Stringer	55
4	Murray Realtors	45
5	Century 21	40
6	Wm. Rigg Realtors	40

Rank	Name	Local Employment
7	Ellen Terry, Realtors	12
8	William White Co. Realtors	11
9	Abio, Adleta & Poston	7
10	Allie Beth Allman Real Estate Inc.	6
11	Clements Real Estate, Inc.	6
12	Mahoney Realty Services Inc.	6
13	Briggs-Freeman Real Estate	3
14	Whiteside Associates, Inc., Realtors	3
15	Matise Realtors Inc.	2

APPENDIX B

STATISTICAL RESULTS OF ANALYSES

NEAREST NEIGHBOR DISTANCE IN MILES

Firm Rank by Size	Accounting	Advertising	Architectural	Banks/S&L	Comm R.E.	Financial Ser	HMOs	Insurance	Law Firms	Print/Publish	Prop Mng	Res R.E.
1	0.3149	0.1131	0.5801	0.3371	0.2722	0.1594	1.0096	1.7232	0	0.9625	0.2155	1.4779
2	0.0717	1.3524	3.2434	0.3862	0.3550	0.0625	0.4041	2.960	0	1.4385	1.8409	0.1541
3	0.1405	0	0.5810	0.1048	1.0588	0.8007	0.1876	1.7232	0.0760	0.3206	0.2121	2.0065
4	0.3787	0.2049	1.6600	2.4353	2.2698	4.3285	0.6619	5.5256	0	1.2031	0.2121	1.4779
5	0.1220	0.1774	1.8134	0.2719	0.0054	0.1038	1.3922	1.4127	0.1236	0.3206	1.7282	7.0187
6	0	0.1812	3.3561	0.2683	0.0028	0.6296	0.8633	6.5388	0	8.6660	2.0824	2.5738
7	0	0.2762	0.8470	1.1635	0.0028	0	0.1381	0	0	0.9064	0.2572	0.3673
8	0.3085	0.2049	0.6521	2.2630	0.5568	0.1354	0.4235	5.5256	0	0.9064	1.1676	3.3570
9	0.2411	1.7451	0.2976	2.6335	1.0534	0.1038	2.4772	0	0	8.666	1.1676	0.0222
10	0.0380	4.8917	4.8723	2.4712	0.3667	0	0.4235	0.0899	0.1556	1.1499	0.2155	0.3673
11	0.2333	0	3.2703	1.6374	0.2722	5.3883	1.3948	2.6836	0	0.9080	0.2044	1.6566
12	0.0196	0.1838	0.2766	0.6915	1.1416	0.0625	0.6619	0.0899	0	2.5639	0.2044	0.0222
13	0.1220	1.3524	0.2976	0.6915	2.8666	0.0559	3.1130	0	0	1.1499	2.5383	0.9078
14	1.7217	2.8427	4.0251	2.4353	0.5568	0	0.1381	0	0	4.6986	0.8106	1.6566
15	0.0380	2.8427	0.2766	1.0564	1.0588	0.1354	0	5.4933	0	0.5678	1.8613	2.8742
16	0.8416	0.1455	0.3700	3.6946	0.8397	0.0751	0	0.1268	0	0.5678	2.5383	
17	3.6830	0.1455	0.3700	0.1048	0.3667	0	3.1130		0	2.5639	1.8409	
18	0.0870	3.6363	0.5801	1.1635	0.6009	2.3266	0.3939		0		3.4069	
19	0.0196	0.1131	0.6521		0.3550	2.3266	1.0096		0		2.1828	
20	0.2333		0.5159		0.6009	0.1640	0.1876		0			
21							0					
Avg NND:	0.4307	1.0742	1.4269	1.3228	0.7301	0.8429	0.8568	2.1183	0.0178	2.2094	1.2993	1.7293
Density:	0.0515	0.0489	0.0515	0.0463	0.0515	0.0515	0.0541	0.0412	0.0515	0.0438	0.0489	0.0386
NND (Random):	2.2037	2.2609	2.2037	2.3229	2.2037	2.2037	2.1505	2.4638	2.2037	2.3902	2.2609	2.5446
Z-value:	-6.8833	-4.3771	-3.0158	-3.4945	-5.7208	-5.2830	-5.2740	-1.0730	-8.4866	-0.5966	-3.5466	-2.3738
Standard Error:	0.2576	0.2711	0.2576	0.2862	0.2576	0.2576	0.2453	0.3220	0.2576	0.3030	0.2711	0.3434
P-value:	0	0	0.0013	0.0002	0	0	0	0.1423	0	0.2743	0.0002	0.0089

Table 12:
Statistical Results of Nearest Neighbor Analysis

	Accounting		Advertising		Architectural		Banks and S&L		Commercial Real Estate		Financial Services	
	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD
	1			1	1		1		1			1
	2			2		2	2			2		2
	3			3		3	3			3		3
		4	4			4		4		4		4
	5			5		5	5			5	5	
	6			6		6	6			6		6
	7			7	7			7		7	7	
	8		8			8		8		8	8	
	9			9		9		9		9	9	
	10			10		10		10		10	10	
		11		11		11		11	11			11
		12		12		12		12		12		12
	13			13		13		13		13	13	
		14		14		14		14		14	14	
	15			15		15		15		15	15	
		16		16		16		16		16	16	
		17		17		17	17			17	17	
	18			18		18		18		18		18
		19		19		19				19		19
		20				20				20	20	
n:	12	8	2	17	2	18	6	12	2	18	11	9
Rank Sum:	97	113	12	178	8	202	34	137	12	198	134	76
Mean Rank:	126	84	20	170	21	189	57	114	21	189	115.5	94.5
Std Dev:	12.9615		7.5277		7.9373		10.6771		7.9373		13.1624	
Z-value:	-2.24		-1.06		-1.64		-2.15		-1.13		1.41	
P-value:	***0.0125***		***0.1446***		***0.0505***		***0.0158***		***0.1292***		***0.0793***	

Table 13:
Statistical Results of Wilcoxon Rank-Sum Analysis

	Health Maintenance		Insurance		Law Firms		Printing and Publishing		Property Management		Residential Real Estate	
	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD	In CBD	Out CBD
		1		1	1			1	1			1
		2		2	2			2		2		2
		3		3	3			3	3			3
		4		4	4			4	4			4
		5		5	5			5		5		5
		6		6	6			6		6		6
		7	7		7			7	7			7
		8		8	8			8		8		8
		9	9		9			9		9		9
		10	10		10			10	10			10
		11		11	11			11		11		11
		12	12		12			12		12		12
		13	13		13			13		13		13
		14	14		14			14		14		14
		15		15	15			15		15		15
		16	16			16		16		16		
		17			17			17		17		
		18			18					18		
		19				19				19		
		20			20							
		21										
n:	0	21	7	9	18	2	0	17	5	14	0	15
Rank Sum:	0	210	61	55	175	35	0	153	25	165	0	120
Mean Rank:	0	231	59.5	76.5	189	21	0	153	50	140	0	120
Std Dev:	0.0000		9.4472		7.9373		0.0000		10.8012		0.0000	
Z-value:	0.00		2.28		-1.76		0.00		-2.31		0.00	
P-value:	***0***		***0.0113***		***0.0392***		***0***		***0.0104***		***0***	

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VITA

James Matthew Bell

Candidate for the Degree of

Master of Science

Thesis: A LOCATIONAL ANALYSIS OF CORPORATE PRODUCER SERVICES IN THE DALLAS, TEXAS METROPLEX

Major Field: Geography

Biographical:

Personal Data: Born in Conway, Arkansas, June 7, 1971, the son of Jim and Brenda Bell.

Education: Graduated from Conway High School, Conway, Arkansas in June 1989; Received Bachelor of Science degree from the University of Central Arkansas, Conway, Arkansas in May 1994; Completed the requirements for the Master of Science degree at Oklahoma State University in July 1996.

Professional Experience: Employed by Oklahoma State University, Department of Geography, as a Lab Instructor and Teaching Assistant, August 1994 to May 1996.

Professional Memberships: Gamma Theta Upsilon, Association of American Geographers.