Spatial Patterns of Headquarters

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Abstract. **This study of the spatial concentration of the headquarters of exchange-listed companies suggests that the relevancy of the "efficiency parameter" of agglomeration theory still holds in explaining the location of headquarters, especially when the production function is reinterpreted as a productivity function. The sample of 5189 headquarters exceeds previous studies of Fortune 500 firms. Across industries, a high degree of clustering is found: 40% of the nation's headquarters were found in twenty counties. Cluster analysis suggests grouping patterns for headquarters; discriminant analysis confirms the uniqueness of these spatial clustering patterns across 229 urban counties. For certain industries, the clustering occurs within small areas. The headquarters of these spatially-correlated groups of firms—money and media, gas and electric, business services, and machining technology—were mapped at the county and zipcode level for counties within major metropolitan areas. The spatial density patterns take on traditional urban forms: core, ring and wedge.**

Introduction

Over the last several decades technological changes, reorganization and downsizing have altered the way firms conduct business. To meet the competition, management varies the range and concentration of its products and services to improve the firm's development, profit and pricing (Porter, 1998). Firms position their headquarters as command and control centers to respond to this competition (Hanson, 1983; and Georgantzas and Shilton, 1992). Business people and economists are divided as to the long range spatial impact of these changes. Will technology and globalization foster decentralization or will firms continue to group, as represented by their headquarters, to benefit from the synergy of clustering to meet the ''complexity of competition'' (Porter, 1998)?

Changes in the concentration of corporate headquarters alter corporate dominance within a metropolitan area and affect the area's growth (Holloway and Wheeler, 1991). Real estate developers, leasing agents and investors examine how the spatial aggregation of headquarters and clusters of headquarters of similar industries affects development and leasing activities within a metropolitan area (Carn, Rabianski, Racster and Seldin, 1988).

This research follows the call of Raper and Ihlanfeldt (1993), that a ''much better understanding of office location choices and the dynamics of office markets could be

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obtained by investigating how office-location behavior varies for different types of office users.'' Continuing from the Holloway and Wheeler (1991) study of the location of headquarters of Fortune 500 firms, this research examines the degree of intermetropolitan and intrametropolitan headquarters clustering for 5198 operating firms listed on the three major stock exchanges in 1996.

This study not only looks at the aggregate clustering of exchange-listed headquarters within metropolitan areas, but at the clusters of headquarters across metropolitan areas. Obviously not all firms are headquartered in an office building, but in a service oriented society more and more economic activity shifts from the plant to the front and back offices.

The theoretical basis for the proposition that firms cluster is drawn from Mill's (1967) agglomeration theory: *i.e.*, spatial proximity assists the transfer of technological and information spillovers and the theory that the firm bundles its functions to minimize transaction and information costs. Updated by Porter (1998), the theory is that growing, new technology firms benefit from agglomeration and the synergistic bundling. Firms that depend upon rapid product differentiation to meet consumer demand benefit from proximity to their competition. The new competition is not necessarily beating the competitors through increased efficiency in the production function, but beating the competition with new products and quicker reactions to the market. Hence, he uses the ''new micro economics'' concept, the *productivity function*, instead of the production function.

As a corollary, competitive firms also have to bid for ''intelligent'' labor that understands the new technology or financial scenarios and prefers to locate in amenity areas or areas that have enriched employment opportunities. In contrast, agglomeration theory suggests that mature firms do not benefit from agglomeration nor spatial proximity. They do not have to bid for labor that is on the cutting edge and in short supply. We do not answer the question of whether spatial proximity benefits a firm or not.[1] In this evolving technological age, we seek to answer the questions of if and how firms spatially congregate.

Cluster analysis and discriminant analysis verification describes the extent and degree of contiguity of headquarters (identified by two-digit standard industrial classifications or SIC) among adjoining zipcodes. Plots show whether headquarters are clustered in traditional urban forms or are dispersed.

Background

Strategic management analysts, economic geographers and real estate analysts, among others, have studied the relationship of the headquarters to the firm, local economy and real estate market.

For the last three decades strategic management analysts have used a firm's vertical and horizontal product diversity as measured by the SIC system to test for levels of competition, ancillary support and financial performance (Montgomery, 1982).

Management understanding has evolved from ''one-way causality'' in which firms influenced their environment to multidirectional relationships in which environment could influence firms (Bedian, 1990). ''Location'' has been cited as a strategic factor in the success of new firms during three of the four major phases of the ''life-cycle'' (Dodge, Fullerton and Robbins, 1994). These management studies, however, have not elaborated on specific spatial patterns of concentration or dispersion of the headquarters.

Recent studies that have focused on the spatial concentration of firms within a given SIC group include Angel's (1989) analysis of the traffic flows of labor between semiconductor plants clustered among a few contiguous districts within a few cities along the Gulf Coast, and the Northeast and Pacific Coasts. This study is reaffirmed by the findings of Ettlinger and Clay (1991) that specialized new technology companies and labor (math and computer scientists and computer engineers) group along the Pacific and Atlantic coasts. In contrast, Schreuder (1995) proposes that inertia maintains the clustering of the pharmaceutical industry within the mid-Atlantic area.

Ellison and Glaeser (1997) pose the question of whether manufacturing plants of 459 manufacturing industries cluster together at the county level. They specifically note that they do not provide reasons why clustering may occur. They use a model of location choice (Herfindahyl Index) that determines whether the plant location was that of a dart thrown at a dartboard or whether spillovers occur among similar industries. Their results provide a ''strong affirmation of the previous wisdom in that we find almost all industries to be somewhat localized.''

Using the 500 major corporations listed by *Fortune* magazine, Holloway and Wheeler (1991) trace the location and moves of the headquarters of firms that made the list from 1980 to 1987. They observe that ''the simple trend of frostbelt decline and Sunbelt growth evident in the 1970s was considerably more complicated in the 1980s.'' Their descriptive analysis concludes that deconcentration of headquarters continues both within industries and within clusters of headquarters across industries. However, they do not detail firms by their industrial sector.

Recent office studies have used employment data grouped by SIC or membership in a Fortune 500 firm to discern hierarchies or clusters of office activity in the metropolitan areas of Orlando and Jacksonville (Archer and Smith, 1992), Boston (Clapp, Pollakowski and Lynford, 1992) and New York (Shilton and Webb, 1995).

In contrast to the preceding studies, this research specifically examines not only the aggregate of headquarters within a metropolitan area, but the contiguity of headquarters of similarly related firms within counties at the zipcode level.

The Theory

Cities exist because there is an ''efficiency parameter'' (Mills, 1967) in the production function for certain types of goods. The production of goods enjoys increasing returns

to scale because of the benefits of contiguity. In a manufacturing environment, contiguous firms benefited because of efficient transportation, labor specialization, technological spillovers and infrastructure support. Business has moved beyond the strict production ''function endowment model'' (Porter, 1998) to the emphasis on increased productivity through specialization and efficiency which are generated in ''particular cluster areas.'' As a corollary, specialized labor will go to labor markets where they hope firms will bid for their services.

How relevant is the theory of the ''physical efficiency parameter'' in explaining urban form and the spatial pattern of headquarters today? In the American economy, less than one third of the working population is employed in manufacturing. The efficiency parameter has shifted from explaining production function to a productivity function in which firms must continue to adapt assess their markets, and tap the synergy of their personnel and their competitors.

In the post-manufacturing era, do headquarters cluster spatially? Real estate textbooks summarize the literature on the urban form that was present during the manufacturing era and suggest that historically cities exhibit one or more types of spatial forms during initial and subsequent development: the core, multiple nodes, the concentric ring, or the wedge or sector. Because of the perceived impact of technology and new forms of communication on industry, the analysts downplay the importance of historical spatial forms in favor of dispersion and exurban lineal strip theory. These perceptions would suggest that headquarters are not clustered spatially, but widely dispersed.

Porter (1998) confirms the bundling theory of the firm and Mills' (1967) production function. The concept of agglomeration is further expanded to include information—both technological and competitive—as a factor. Some firms need only low levels of technological/market information; other firms need technological information and ''fresh'' market information.

Those firms that need technological information or fresh market information will cluster because they need the information through face-to-face contact—''the glue of office markets'' (Clapp, 1993) and by hiring the ''intelligent'' labor that has this information. As a corollary, intelligent or smart labor will go to those metropolitan areas in which a cluster of firms will bid for their services.

The Cobb-Douglas production function is commonly used as a starting point to explain urban form (Mills, 1967; and Ciccone and Hall, 1996):

$$X = AL_d^{\alpha}N^{\beta}K^{\kappa}, \tag{1}$$

in which:

X = Total output of goods, with the contemporary emphasis on the evolution of an array of goods;
L_d = Land at distance d from a central point; the further the distance from a central point the less contribution of land (the alpha factor) to output;

N = Labor;
K = Capital; and
A = Parameters.

In a manufacturing society physically constrained by transportation, businesses locate at those points that maximize production for given units *LNK*.

The efficiency parameter is imbedded in this function. There is a tradeoff between locating at a central point to attract specialty labor and paying for the cost of locating in that area. We suggest that this function should be modified to explicitly recognize that information is a part of the production function and now, the productivity function focuses s on evolving products.

$$X = AL^{\alpha}N_b^{\beta}N_s^{\sigma}K^{K}I_e^{\varepsilon}I_f^{\phi}, \tag{2}$$

in which:

X = Total output of goods, the array of goods;
L = Land;
N_b = ''Back office labor'' labor;
N_s = ''Smart office'' labor;
K = Capital;
I_e = Electronic information;
I_f = Face-to-face information; and
α, β, σ, K, ε, ϕ = Cobb-Douglas parameters that add to one.

Two types of growth firms emerge: firms that minimize the input of costly land and firms that maximize increased information and specialized smart labor (Nicholson, 1978):

$$G_x = G_A + E_{X,L}G_L + E_{X,I}G_I, \tag{3}$$

in which:

G_X = Growth in output;
G_A = Growth to other external factors;
$E_{X,L,}G_L$ = Elasticity of growth, change in land input; and
$E_{X,I,}G_I$ = Elasticity of growth, change in information and smart labor input.

This study does not measure the growth or changes in inputs. The purpose of this section is only to propose a rationale as to why firms would be in proximity or not. The close proximity of firms in a given industry suggests that the firms believe growth depends on face-to-face information and/or that they are competing for an intelligent labor pool as suggested by Angel (1989). At this stage of research, it is not the purpose of the study to prove that proximity does improve growth.

Firms have varying information and data needs: (1) current information and labor necessary for the technological advancement of the firm/industry; (2) current information and labor necessary for creation and marketing of the products of the firm; and (3) historical information carried by less fluid labor that once was essential for the survival of the firm.

Information is conveyed mainly in two forms: electronically or face-to-face through smart labor. If electronic information suffices for the production process, then all land is generally equidistant to multiple points, the hexagon model (Mills, 1967). Land is a necessary factor for production but is no longer a variable that contributes to economies of scale. If face-to-face information in a labor form is critical to the production process, then the contribution of land to production increases as the distance to central points diminishes. When raw material costs or transportation costs become negligible, labor costs become a key production input. If the need is for smart labor, industries will locate in amenity-laden areas that include attractive physical settings, cultural attractions and pleasant weather.

As a corollary, for each appropriate skill level, labor seeks to locate in an area to maximize its compensation. In flexible dynamic industries, labor will maximize its compensation by seeking amenity areas and those areas that reduce the cost of job searches (Nicholson, 1978).

While electronic information is not space dependent, smart labor and face-to-face contact requires relatively smaller spatial spheres of operation. During the life cycle of a firm/industry the relative importance and cost of information in the production of goods will vary. At startup for a new technology, all forms of information—public, private and what competition is doing— are critical. For a consumer-sensitive, product differentiated industry (fashion, financial instruments), all forms of information are critical. In contrast, in a mature, stable product line industry, electronic information about sales and performance suffices. For many of these mature industries, however, critical information was needed at startup.

Because modern business society evolved more than two transportation eras—before interstates and after interstates—two contiguity patterns exist. For cities that developed pre-interstate, central point cluster predominate for those industries that need to be face-to-face. In cities that grew after the introduction of the interstates, clusters along the major highways predominate.

The primary hypothesis of this study is that at least two patterns of headquarters will emerge: (1) contiguous clusters of headquarters for specialized SIC groupings; and (2) spatial dispersion for the other SIC groupings.

We also expect from Equation (2), that there is a positive elasticity between the number of headquarters in an area and the level of wages in the area. The greater the number of headquarters, the greater the number of intellectual specialty skills needed.

This study does not attempt to prove that proximity improves financial performance or market share. It seeks to discern if and where clustering occurs. If clustering occurs,

then subsequent tests as to whether spatial proximity of headquarters improves upon financial performance or not would be warranted.

Data and Research Design

A database was created from the directory of firms provided by Demand Research that details the characteristics and location of each firm listed on the New York, American and NASDAQ exchanges.

From their data files, Compustat provides historical financial data and current county data. The primary four-digit SIC code for each firm was truncated to one of 69 two-digit SIC codes. The metropolitan code, county code (fipsco) and zipcode for each headquarters were recorded to each firm. Primary accounting data as coded by Compustat was recorded for each firm for the latest report ending June 1996. Because the focus of this research was on active urban corporations, firms with headquarters in rural counties and mutual funds and trusts were omitted. As a result, the number of firms totals 5,198.

For each metropolitan area, we tallied the total number of headquarters and recorded the Bureau of Economic Analysis per capita income for 1994 for the larger 47 metropolitan areas in addition to the total employment, diversity of the employment and the diversity of the headquarters within each.

Previously it has been shown that the headquarters of firms concentrate with larger metropolitan areas. The propositions of this research are: (1) headquarters no longer cluster; (2) headquarters cluster, but randomly; (3) headquarters cluster, but within industry groups or complimentary industry groups; (4) if headquarters do cluster within industry groups, the spatial patterns reflect pre and post automobile age development and transportation: central place, core city versus metropolitan wide, highway groupings; and (5) as the total number of headquarters increases across metropolitan areas, per capita income, as a proxy for wage levels, will rise.

Two approaches of cluster analysis and verification by discriminant analysis (Shilton and Webb, 1995) are used to discern county level aggregation of firms by SICs. Cluster analysis suggests possible groupings. Discriminant analysis validates the statistical significance of the clusters.

Tabular frequency analysis proved useful in constructing a reduced matrix for correlations. For each of the 69 SIC industrial groups, national urban totals were computed (Exhibit 1). For each two-digit SIC, the maximum and minimum number of headquarters per county for the 667 counties were found. Correlation analysis was performed only on those SIC groups in which the number of headquarters within at least one county exceeded ten.

Highly correlated groups of SICs were mapped for the top twenty headquarter concentration counties at the zipcode level. A contiguity percentage was devised to

Exhibit 1
Number of Headquarters by Two-Digit SIC Groupings (5198)

Headquarters	SIC	Headquarters	SIC
BANKS	556	FOODSTR	36
ELECMAC	384	OILREF	34
INDSMAC	354	HOMESTR	34
CHEMICAL	331	STONEPR	31
BUSSERV	297	RUBBER	30
MEASMAC	286	AIRTRANS	30
GASELEC	232	FURNITUR	28
INSCOMP	187	METALMIN	27
HEALTH	136	LUMBPR	27
OILGAS	134	MISCBUS	26
COMMUN	130	INSAGNT	25
WHDUR	110	HOTELS	25
TRANSMAC	108	LEATHER	20
ENERGY87	98	WHBLDG	19
FOODPROD	96	EDUC	19
MISCRTL	91	RAILROAD	14
FABMETAL	91	PERSSERV	14
EATING	83	HIWAYCON	14
PRIMETAL	82	WATERTRN	13
MISCMAC	82	AUTOSERV	12
CREDIT	73	AUTODLR	11
PRINTING	72	AGRGRAIN	10
WHDUR2	63	TRANSERV	9
APPAREL	61	CONSTSPC	8
PAPER	57	TOBACCO	6
AMUSE	56	QUARRY	6
BROKERS	51	PIPELINE	6
APPLSTR	50	TRANSIT	3
REALEST	46	FOREST	3
MOTORFRG	46	AGRCHICK	3
TEXMILL	42	SOCSERV	2
MISCSERV	42	AGRSERV	2
MOTION	41	FISHING	1
GENMER	41	AGRSTOCK	1
GENCONST	40		

determine the percentage within these counties by SIC grouping of those headquarters that were in adjoining zipcodes.

From the correlation analysis, clustering was performed on the 69 SIC groups across the 229 counties with four or more headquarters to determine that several industry groups clustered differently across urban counties.

The canonical functions of discriminant analysis of the resulting clusters across the 229 counties verified the statistical significance of the unique clustering of these industry groups.

Results

Following the economic maxim that agglomeration is a function of density, headquarters in the United States are concentrated: twenty counties account for 40% of all headquarters (Exhibit 2). The location of the counties with high numbers of headquarters is about evenly split between the established northeast and midwest and the newer west and southern sections, confirming the observations of Holloway and Wheeler (1991).

The wealth of the new technology firms still does not match the wealth of the mature auto industries of Detroit (Wayne County) and the banking and investment of firms located in New York (Exhibit 3). Counties with a higher number of firms are not necessarily those counties in which firms control a greater amount of assets.

At the county level, 16 of the two-digit SIC industries showed evidence of clustering by having at least ten headquarters each in one or more counties. The remaining 53 industry groups were widely dispersed across 667 urban counties. The correlations were generally less than 30% (Exhibit 4).

Headquarter Clusters by Industrial Sector

The clustering was performed across SICs and across urban counties. From a matrix of 69 SIC groups across 229 urban counties, industries that cluster their headquarters are: (1) electrical machinery, measurement machinery, industrial machine and miscellaneous machines; (2) business services; (3) oil and gas, and gas-electric utility industries; (4) insurance companies, brokers (investment houses) and communication companies; (5) banks; and (6) all others.

The canonical discriminant function for each cluster is statistically different as evidenced by the significance of the Chi-square statistic (Exhibit 5). Each specifically identified function of an industrial sector of headquarters identifies a cluster pattern across the urban counties.

The headquarters of the specific SICs described, from ‘‘a to e,’’ totals 2,693, (over half the 5189 total) of which 1089 are found within the top 20 counties listed in Exhibit 2. Headquarters are generally located along the two coasts (Exhibit 6).

Exhibit 2
Cumulative Percentage by Number of Headquarters Across Counties

County	Headquarters Count	Cumulative Percentage	*F*-Statistic*
Los Angeles, CA	204	4	15.42
Santa Clara, CA	203	8	859.49
New York, NY	193	12	60.23
Cook, IL	154	15	19.39
Harris, TX	152	17	80.43
Middlesex, MA	147	20	329.25
Dallas, TX	145	23	7.49
Hennepin, MN	108	25	104.20
Fairfield, CT	90	27	18.45
San Diego, CA	84	28	114.89
Orange, CA	83	30	64.06
Fulton, GA	65	31	6.14
King, WA	62	33	44.18
Alameda, CA	56	34	417.85
San Mateo, CA	54	35	184.38
Cuyahoga, OH	54	36	19.99
Nassau, NY	53	37	11.92
Maricopa, AZ	48	38	4.99
Suffolk, NY	48	39	28.88
Suffolk, MA	45	40	15.91

Note: *F*-Statistics are differences across clusters. All are significant at the 95% or greater confidence level.

Technology and business services rule the west, money and business services predominate in the east and energy rules the mid southwest. Although Atlanta is one of the fastest growing metropolitan areas, its growth is not a function of the number of headquarters.

The Holloway-Wheeler study did not group headquarters by industrial type within a metropolitan area. This study confirms that clusters of headquarters are not homogeneous across the counties (Exhibit 2). (If headquarters groups are similarly distributed within a county, the *F*-Statistics would indicate a confidence level of less than 90%; they are not.) This lack of homogeneity suggests that corporate clusters vary in their uniqueness among the major metropolitan counties. This uniqueness invites further scrutiny as to the impact upon the economic base of these counties.

Exhibit 3
Ranking by Assets of Firms Headquartered in a County

F-Statistic	County	Number of SICs	Number of Companies	Sum of Company Assets (in millions of $)
60.23	New York, NY	43	193	2,714,191
1.79*	Wayne, MI	13	23	538,425
19.39	Cook, IL	46	154	488,389
10.27	San Francisco, CA	26	44	465,617
18.45	Fairfield, CT	32	90	428,088
5.33	Washington, DC	11	14	403,742
15.42	Los Angeles, CA	48	204	353,271
3.18*	Mecklenburg, NC	18	23	330,221
80.43	Harris, TX	36	152	243,991
7.49	Dallas, TX	46	145	213,333
15.91	Suffolk, MA	22	45	210,397
11.81	Hartford, CT	17	33	209,652
5.99	Philadelphia, PA	23	30	203,563
20.26	Allegheny, PA	18	42	198,273
104.21	Hennepin, MN	36	108	195,049
6.14	Fulton, GA	31	65	188,931
3.92*	Westchester, NY	23	34	178,054
19.99	Cuyahoga, OH	22	54	169,812
11.84	Fairfax, VA	15	28	144,652
1.38*	Franklin, OH	21	36	142,580
21.80	St Louis, MO	25	44	142,562
859.49	Santa Clara, CA	20	203	106,076
36.42	Hamilton, OH	23	35	105,585
44.18	King, WA	25	62	97,549
11.06	Richmond, VA	15	24	92,812
8.31	New Castle, DE	13	21	92,283
20.01	Contra Costa, CA	18	25	91,567
8.30	Jefferson, AL	12	23	91,375
30.70	Morris, NJ	10	17	77,590

Note: *F*-Statistic is difference across clusters.
* Significant at the 95% confidence level.

However, when counties are ranked by the asset size of the firm and not the number of headquarters (Exhibit 3), several counties are not unique in their clusters. A possible explanation is that these counties are older centers in which the largest firms remain because of inertia (Hanson, 1983).

Exhibit 4
Correlation Across Counties Among Selected SIC Groups with Large Number of Headquarters

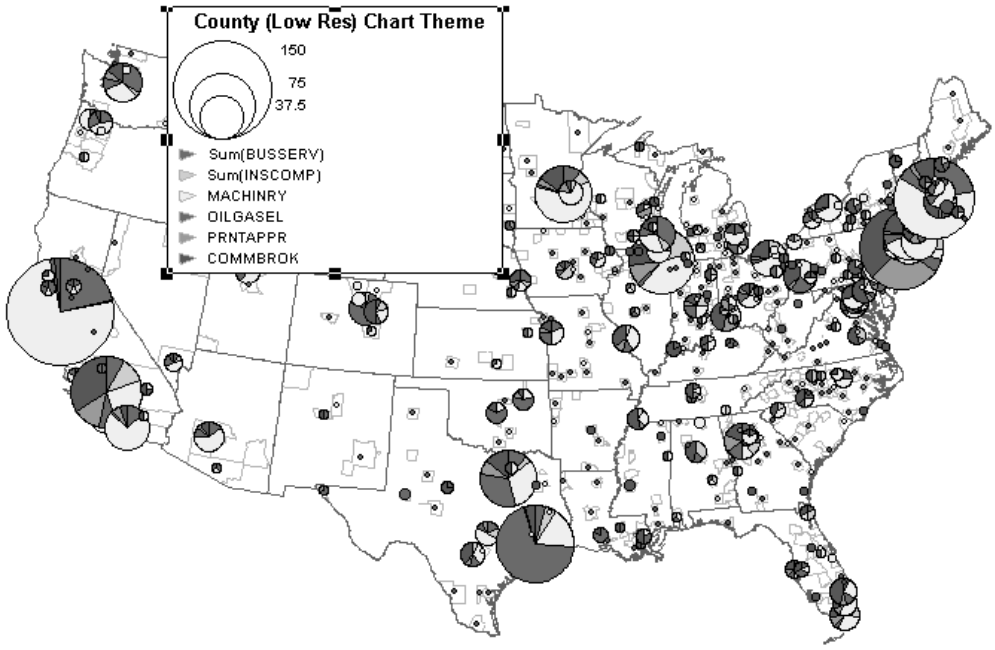
	TOTAL	BANKS	INSCOMP	BROKERS	COMMUN	OILGAS	GASELEC	BUSSERV	MISCMAC	MEASMAC	ELECMAC	INDSMAC	PRINTING	APPAREL
TOTAL	1.00													
BANKS	0.69	1.00												
INSCOMP	0.69	0.61	1.00											
BROKERS	0.52	0.45	0.73	1.00										
COMMUN	0.60	0.47	0.73	0.68	1.00									
OILGAS	0.37	0.11	0.20	0.07	0.13	1.00								
GASELEC	0.68	0.44	0.44	0.26	0.35	0.66	1.00							
BUSSERV	0.74	0.37	0.27	0.21	0.27	0.10	0.41	1.00						
MISCMAC	0.75	0.58	0.57	0.49	0.55	0.05	0.35	0.53	1.00					
MEASMAC	0.71	0.37	0.21	0.11	0.15	0.14	0.38	0.82	0.51	1.00				
ELECMAC	0.70	0.28	0.20	0.12	0.17	0.05	0.27	0.83	0.50	0.72	1.00			
INDSMAC	0.76	0.38	0.29	0.15	0.19	0.16	0.40	0.83	0.50	0.87	0.82	1.00		
PRINTING	0.65	0.57	0.80	0.81	0.73	0.12	0.38	0.27	0.60	0.18	0.18	0.23	1.00	
APPAREL	0.59	0.53	0.76	0.83	0.71	0.08	0.30	0.22	0.57	0.15	0.15	0.16	0.84	1.00

Exhibit 5
Significance of Canonical Discriminant Functions

Fcn	Eigenvalue	Percentage of Variance	Cumulative Percentage	After Fcn	Chi-Square	df	Sig*
				0	1423.85	354	.0000
1	10825.59	46.6	46.6	1	1117.29	290	.0000
2	9126.90	39.3	85.9	2	816.36	228	.0000
3	2297.05	9.9	95.8	3	560.94	168	.0000
4	442.03	1.9	97.7	4	359.85	110	.0000
5	385.00	1.7	99.4	5	163.31	54	.0000
6	139.99	0.6	100.0				

*Significant at the 99% level.

Exhibit 6
Concentrations of Headquarters in the United States



Circle size reflects total number of headquarters within a county. Shading is the proportion of each major SIC industrial sector.

Clustering within Counties

The mix of headquarters by industrial clusters varies across the counties. Only 31 of the 229 counties had a mix of headquarters in which there was no significant difference (at the 90% confidence level) in the mix of headquarters.

The maps illustrating the degree and level of concentration of headquarters presented here include most of the top 20 counties. Headquarters for each of the 4 major SIC groups were plotted at the zipcode level. Each circle represents the total number of headquarters in a zip and the pie wedges in the legend show the percentage of that total for each of the 6 major SIC groups. Several patterns of contiguity are suggested by the maps: (1) concentrations of either a single or several industries; New York, Boston, Silicon Valley (San Francisco) and Los Angeles; (2) directed contiguous dispersion of either a single or several industries: Houston, Denver, Dallas and Atlanta; and (3) dispersion: Minnesota and Washington, DC.

A common theme throughout is that the technology and business services are on the outskirts; money and media are at the core. Across the majority of areas, the clusters of headquarters reaffirm past historical urban forms: core, ring or wedge.

Concentration Pattern

New York

New York has two money centers: Manhattan and Fairfield Connecticut, two nodes of technology and business services on Long Island and the directed dispersion of technology and business services along the major transportation routes in New Jersey (see Exhibit 7).

Boston

Boston repeats the New York pattern with a money core, a residual of old wealth and a technology core that is sustained by university association (see Exhibit 8). The directed linear dispersion following the ring roads becomes greater once beyond the post automobile loop route 128.

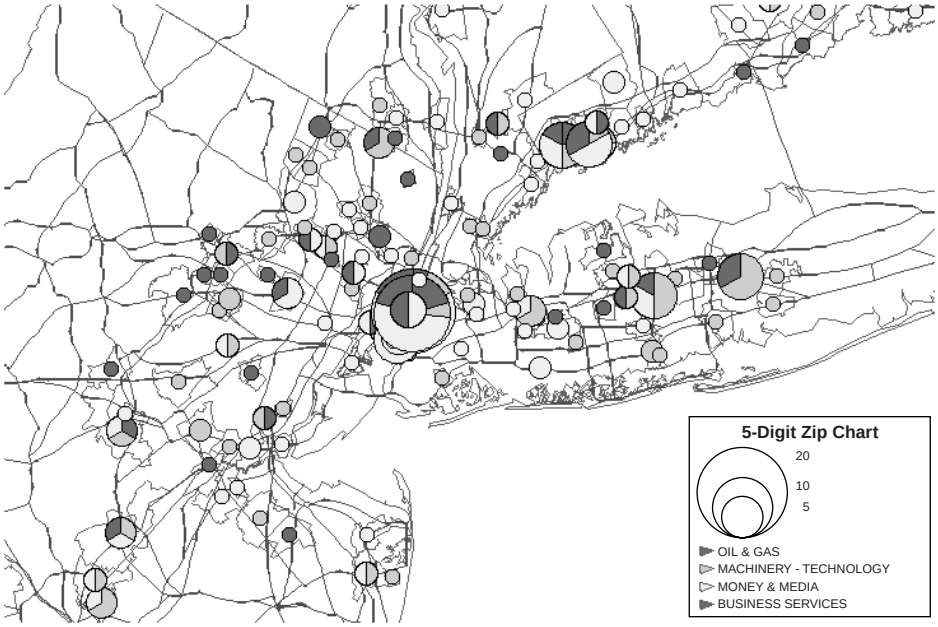
San Francisco-Silicon Valley

After sprawling Los Angeles, Santa Clara County had the highest number of headquarters in the U.S., and 95% of them were in the technology and business services industries (see Exhibit 9). Weakly repeating the Boston pattern with a greater spatial gap between the money headquarters of, San Francisco sat on the old money and the new technology center of Santa Clara.

Los Angeles

Although tagged as a city without a downtown, Los Angeles has witnessed firms creating their own nodes: the money nodes of downtown, Century Boulevard and the

Exhibit 7
Concentrations of Headquarters in the New York Metropolitan Area



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 8
Concentrations of Headquarters in the Boston Metropolitan Area

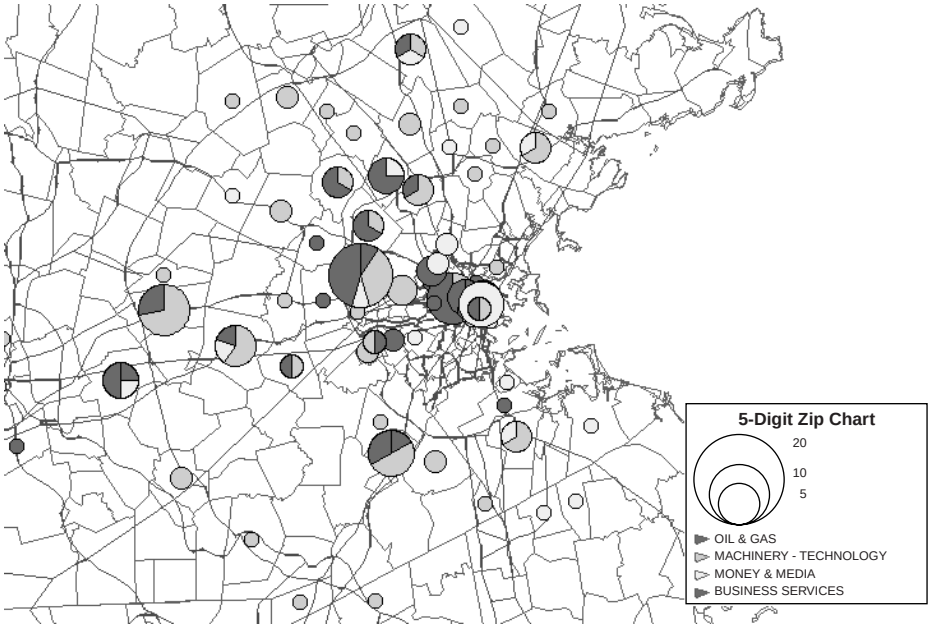
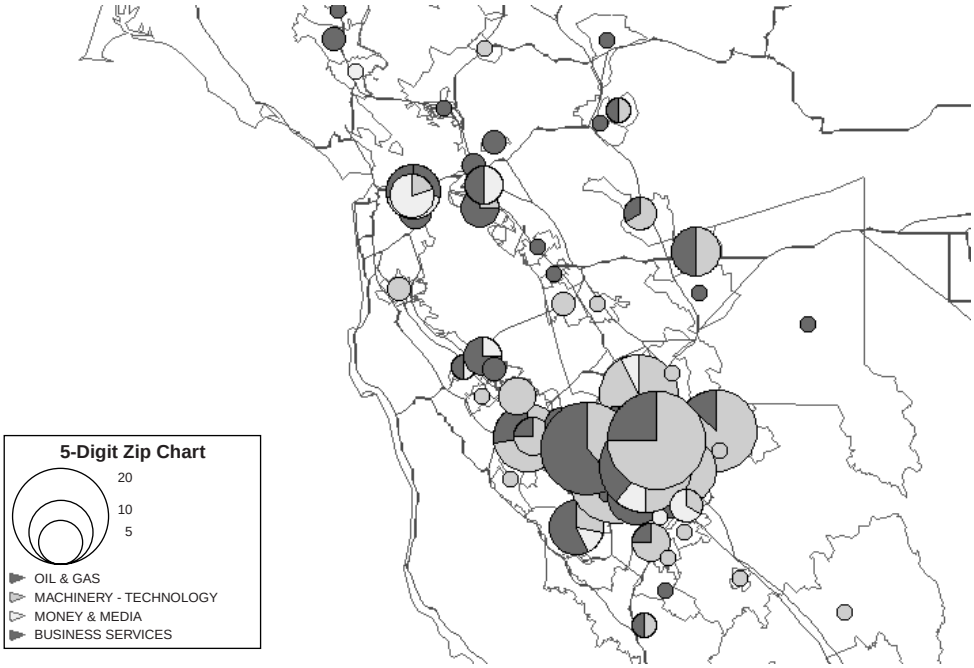


Exhibit 9
Concentrations of Headquarters in the San Francisco–Silicon Valley Area



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

northern hills, and the technology and business service node of Orange County (see Exhibit 10). Despite the openness of miles of freeways, firms have settled along the contiguous strip of the coastal freeway.

Directed Dispersion

Houston

Clearly a one industry town, oil and gas, Houston exemplifies the desire and need to be close to the headquarters of the competition (see Exhibit 11).

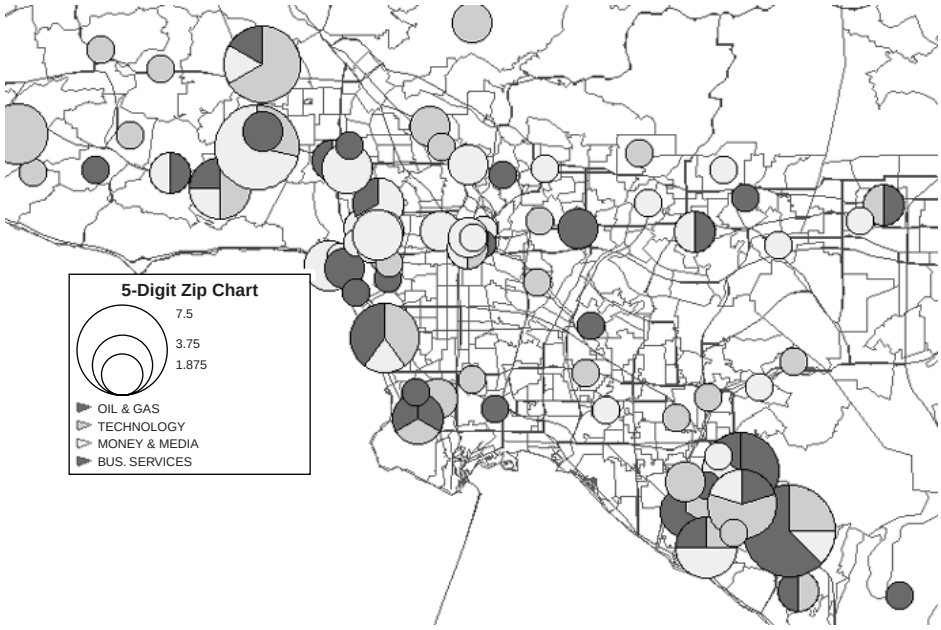
Denver

Money, on the outskirts, is secondary in Denver to the major point of doing business: oil, gas and energy (see Exhibit 12).

Dallas

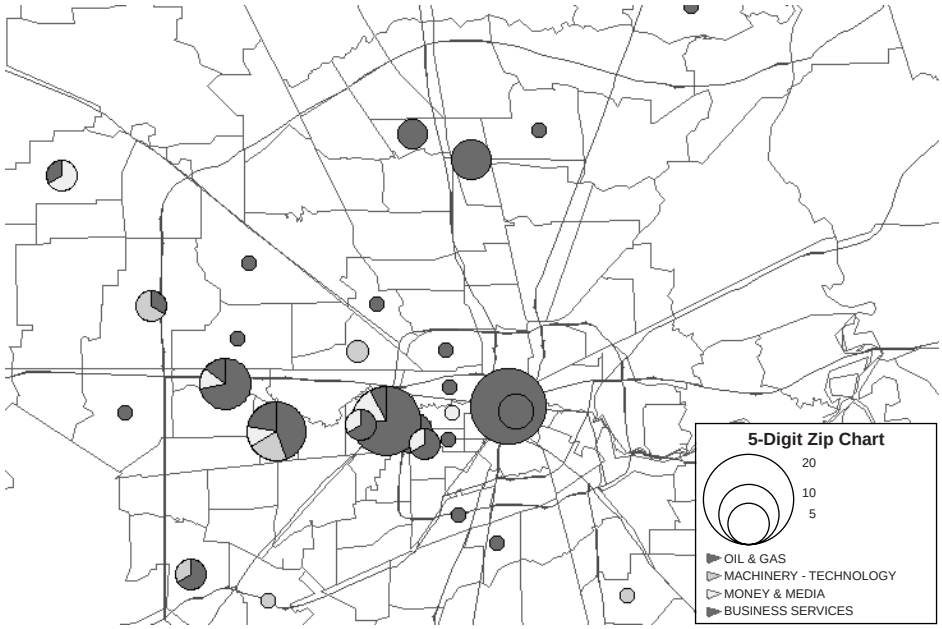
A modern day version of the growth wedge anchored by the primary oil and gas and business services in the center and evolving more diversely to the north (see Exhibit 13).

Exhibit 10
Concentrations of Headquarters in the Los Angeles Metropolitan Area



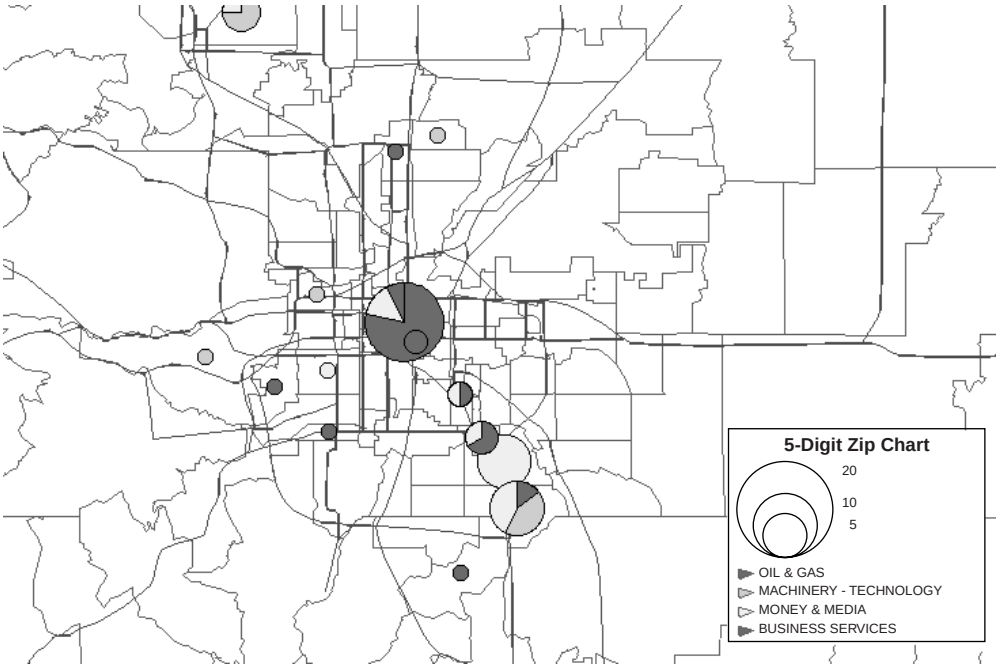
Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 11
Concentrations of Headquarters in the Houston Metropolitan Area



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 12
Concentrations of Headquarters in the Denver Metropolitan Area



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Dispersion

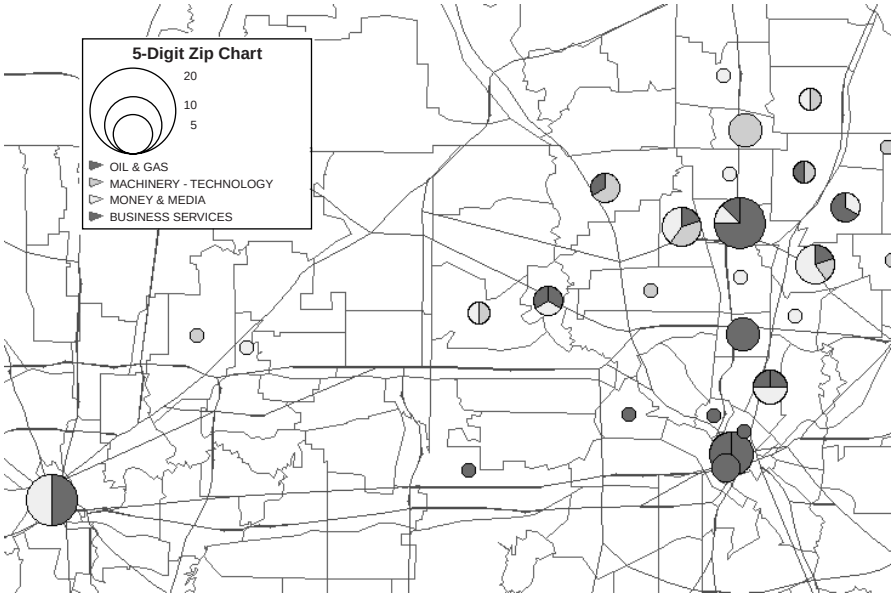
Minneapolis, Washington, DC and Atlanta. Patterns are too nascent to label (see Exhibits 14–16). Without a major predominant group, there appears to be no need to congregate. In Minneapolis, the outer ring road stitches together the headquarters, but for Washington, D.C. and Atlanta, the importance of proximity to major interstates is not obvious. It appears the lower the number of competitors, the more disperse are the headquarter sites.

Summary of Spatial Clustering

The maps show varying degrees of density among headquarters. The degree of contiguity among the top 20 counties is summarized in Exhibit 17. The 20 counties account for 1089 of the 2693 firms listed in the major SIC groups of money and media, oil and gas, business services and technology. For these 20 counties,

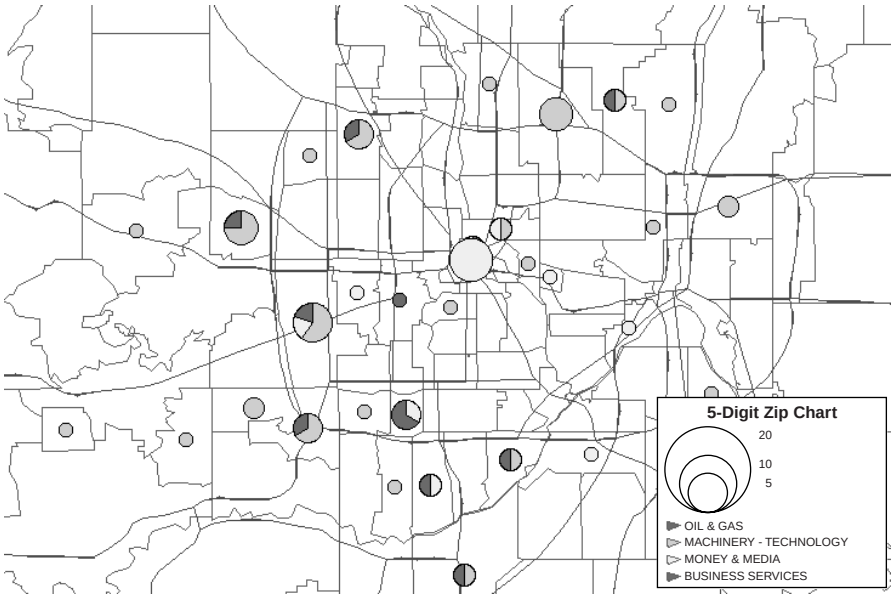
- Media and money: 174 out of 259, or 67% headquarters were in zipcodes next to their competitors.
- Business services: 145 out of 155, 94% were in zipcodes adjoining their competition.

Exhibit 13
Concentrations of Headquarters in the Dallas–Forth Worth Metropolitan Areas



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 14
Concentrations of Headquarters in the Minneapolis Metropolitan Area

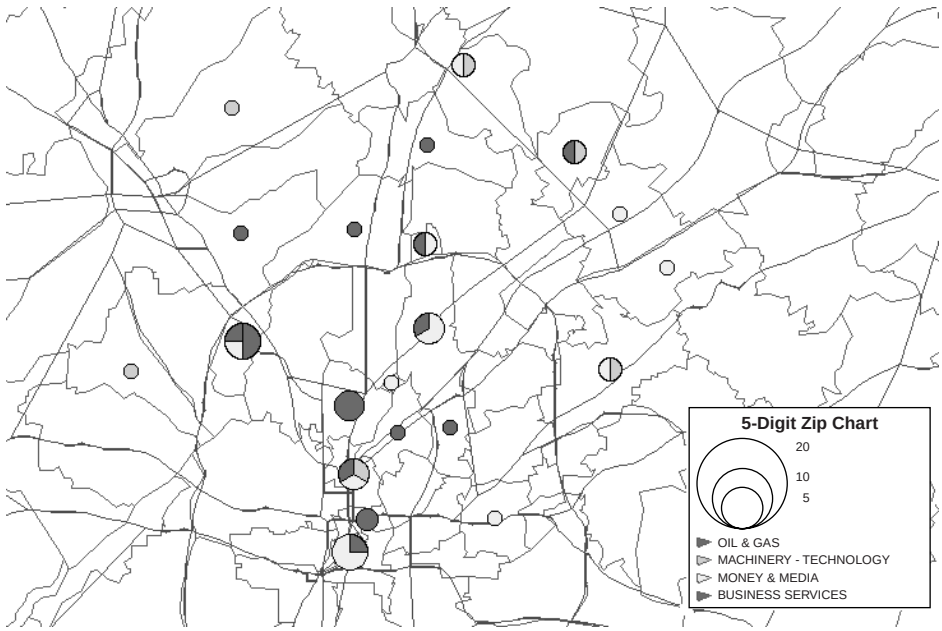


Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 15
Concentrations of Headquarters in the Washington D.C. Metropolitan Areas

Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 16
Concentrations of Headquarters in the Atlanta Metropolitan Area



Circle size reflects total number of headquarters within a zipcode. Shading is the proportion of each major SIC industrial sector.

Exhibit 17
Concentration of Headquarters—Percentage of Headquarters within Contiguous Zipcodes

County	Total # Media & Money	Percentage in Adjoining Zipcodes	Total # Business Services	Percentage in Adjoining Zipcodes	Total # Technology	Percentage in Adjoining Zipcodes	Total # Oil & Gas	Percentage in Adjoining Zipcodes
Los Angeles, CA	40	63	7	29	29	10	8	0
Santa Clara, CA	4	0	37	100	133	66	2	0
New York, NY	63	65	6	100	9	67	6	0
Cook, IL	30	70	5	100	32	56	2	0
Harris, TX	9	89	4	0	16	0	66	89
Middlesex, MA	9	100	23	139	64	75	6	0
Dallas, TX	10	100	6	0	19	0	18	100
Hennepin, MN	13	92	6	83	39	46	1	0
Fairfield, CT	21	52	2	100	23	43	3	0
San Diego, CA	2	0	5	100	28	68	1	0
Orange, CA	6	83	5	60	28	0	3	0
Fulton, GA	8	0	7	100	4	0	4	75
King, WA	5	0	10	100	10	40	3	0
Alameda, CA	3	0	10	0	30	57	0	0
San Mateo, CA	3	0	8	0	15	67	0	0
Cuyahoga, OH	9	78	0	0	15	20	1	0
Nassau, NY	7	43	3	67	11	27	1	0
Maricopa, AZ	2	0	3	0	16	63	2	0
Suffolk, NY	3	0	3	0	19	63	1	0
Suffolk, MA	13	67	5	40	5	40	2	0

Exhibit 18
Per Capita Income as a Function of Headquarters

Variable	Coeff.	Std. Err.	T	Sig T
LN EMPLOYMENT	−.053	.025	−2.14	.039**
LN HDQ DIVERSITY	.112	.055	2.05	.048**
LN TOTAL HDQ	.062	.033	1.92	.064*
Constant	10.684	.349	30.62	.000

Note: The dependent variable is the log of per capita income (BEA metorpolitan). Multiple R = .647; R^2 = .419; Adj. R^2 = .369; and Std. Err. = .116. The analysis of variance for regression: DF = 3; Sum of Squares = .338; and Mean Square = .113. The analysis of variance for residual: DF = 35; Sum of Squares = .469; and Mean Square = .013. F = 8.400 and Sig F = .0002.
*Significant at the 90% confidence level.
**Significant at the 95% confidence level.

- Technology: 271 out of 545, 50% were close to their competition.
- Oil and gas: 80 out of 130, or 61.5% were in zipcodes adjoining their competition.

For these 4 industries, more than 61% of the firms twenty counties are in proximity to their competition.

Income Levels and Headquarters

The modified Cobb-Douglas function implies an elasticity function for measuring the relationship between the total number and diversity of headquarters and the income earned in a metropolitan area. Other factors could influence wage levels including the size of the metropolitan area, the diversity of the employment, the cost of living and the cost of doing business and the diversity of the headquarters. These variables were tested. The significant variables are listed in Exhibit 18. Earnings are a function of the diversity and the number of headquarters in a metropolitan area and inversely related to the total employment. The regression results suggest that it is not the size of the workforce, but the complexity of the corporate headquarters cluster that drives the wage level.

Conclusion

Previous studies have found that the largest Fortune 500 firms continue to maintain their headquarters in the largest metropolitan areas. Based on a much larger sample, this research confirms the gravitational pull by the large metropolitan areas for the headquarters of varying size firms listed on the three major stock exchanges. Even though technological change, reorganization and downsizing have occurred, tight spatial clusters of corporate headquarters are found in metropolitan areas.

From the sample of 5,198 firms, the following spatial headquarter patterns occur:

- Some metropolitan areas host the headquarters of certain industries.
- Other metropolitan areas host a more diverse group of headquarters, but spatial clustering of these diverse headquarters occurs within the metropolitan area.
- Firms of other industrial sectors locate their headquarters across cities and do not cluster within cities.

Given the continued reports about decentralization in the economy, the growth of dispersed or lineal cities, and the impact of the electronically linked firm, the degree of spatial clustering is more than we expected. Twenty urban counties account for 40% of all headquarters. However, not all industrial sectors are proportionately represented in each of these urban counties. Metropolitan areas have unique mixes of headquarters. These mixes and the need for skilled, ''smart'' workers drives the earnings level, not the size of the workforce.

Industrial sectors that cluster include technology and machining, oil and gas, business services and money-communications related firms. Out of the 2693 headquarters in these sectors, 669 headquarters were in contiguous zipcodes to their competition. While the results show that wage levels are a function of the complexity of the headquarters structure within a metropolitan area, there still remains the question of why headquarters cluster within certain sub-market of the metropolitan area.

The efficiency parameter, depicted not in the neoclassical production function, but in Porter's information input requirement for the productivity function, may explain clustering. The dichotomy between firms that cluster their headquarters and those that do not invites the investigation as to whether spatial proximity among similar firms is a factor in the financial performance of the firm.

Conversely, the uniqueness of clusters of firms with their multidirectional relationships may in part explain the variance of economic behavior and cycles of the real estate markets in metropolitan areas. Further research is required.

Note

[1] Preliminary results suggests that proximity does benefit firms (see Shilton and Stanley, 1999).

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