The Changing Geography of the U.S. Banking Industry

Robert DeYoung
Federal Reserve Bank of Chicago
Senior Economist and Economic Advisor
Economic Research Department
Chicago, IL 60604

Thomas Klier
Federal Reserve Bank of Chicago
Senior Economist
Economic Research Department
Chicago, IL 60604

Daniel P. McMillen
University of Illinois at Chicago
Professor
Economics Department
Chicago, IL 60612

ABSTRACT

The U.S. commercial banking industry provides a unique laboratory for studying the effects of regulatory and technological change on the geography of urban economic activity. We explore whether and how three fundamental facets of banking geography changed during the 1990s: bank headquarters locations, bank branch office locations, and bank depositor locations. We find that (a) mergers and acquisitions have allowed large publicly-traded banks to move their company headquarters from smaller cities to larger cities, consistent with the existence of agglomeration economies available to banking companies, (b) bank branches have moved substantially farther away from bank headquarters, evidence that banking organizations have become less geographically centralized, but (c), despite these and other strategic changes by banks, the spatial density of bank deposits in the 50 largest metropolitan areas has remained remarkably stable over time.

INTRODUCTION

THE CHANING GEOGRAPHY OF THE U.S.BANKING INDUSTRY

The commercial banking industry in the United States offers a unique and, to date, little exploited opportunity to study the geography of urban economic activity. For decades, commercial banks had been geographically constrained – by the McFadden Act of 1927 that prohibited commercial banks from operating across state lines and additionally by state laws which restricted banks' ability to branch across county lines and in many states prohibited branch banking entirely. In addition, both

the states and the federal government were reluctant to grant charters to new commercial banks, fearing that "excess" competition would lead to bank failures and financial instability. By 1980 there were 14,434 commercial banks in the United States, virtually unchanged from the number of banks almost 50 years earlier. The typical bank was small, locally focused, and on average operated just 2.68 branches.

Since 1980 these artificial geographic restrictions have been eliminated almost entirely, with dramatic consequences for the structure of the U.S. banking system. The Riegle-Neal Act of 1994 permits banks to operate across state lines, striking down the McFadden Act and codifying at the federal level actions taken by the majority of state legislatures over the previous two decades to gradually ease and finally remove branching restrictions. As these regulatory constraints vanished, banks expanded into new geographic markets, primarily by acquiring or merging with banks in other cities and states. Advances in telecommunications, information technology, and risk management practices supported banks' geographic growth by improving the ability of headquarters staff to make and monitor loans far away from headquarters. Although federal and most state banking agencies eased their chartering policies, resulting in over 4,000 new bank charters between 1980 and 2002, these "de novo" bank entrants only partially replaced the thousands of banks that disappeared via mergers. By 2002 only 7,887 commercial banks remained, approximately halving the population in a little over two decades.

Banks also exercised their new-found geographic freedom by opening new branches. Between 1980 and 2002 the number of branches of commercial banks in the United States increased by 70%, and by 2002 the average commercial bank was operating 8.39 branches. This near tripling in branch intensity occurred as thousands of banks were developing and deploying Internet web sites, and over one hundred thousand new automated teller machines (ATMs) were brought on line – new technologies which theoretically reduced the need for bank branches as customer points of contact.[1]

These exogenous changes in regulation and technology, and the relatively rapid transition from a geographically constrained to a geographically unconstrained industry equilibrium triggered by these changes, present a natural experiment in urban economic geography. By observing changes in the locations of bank headquarters and bank branches over time, we address three related sets of questions. First, did geographically deregulated banking firms relocate their headquarters to larger cities to take advantage of agglomeration economies, similar to the organizational forms increasingly adopted by nonbanking firms? Second, has there been any change in

[1] Furst, Lang, and Nolle (2002) and DeYoung, Hunter, and Udell (2004) provide evidence on the expansion of these retail banking delivery channels.

the spatial structure of banking organizations? Did banking firms become less centralized by expanding their geographic footprints into new cities and states – a change that would enhance competition in local markets – or did banking firms become more centralized by packing more points of customer contact into a given geographic area – a change that could potentially enhance their local market power? And third, how have banks responded to changing household location, given banks' greater freedom to operate across larger geographical areas? Has the geographic profile of banking offices and branches in urban areas become more or less closely aligned with the geographic profile of urban population and income?

Several studies have examined the effects of deregulation and new technology on the geography and spatial distribution of the U.S. banking industry. Holly (1987), Lord (1992), and Zhou (1998) are examples.[2] These studies identify the presence of large banking companies, created as a result of banking consolidation, as a crucial force in shaping the spatial structure of this industry. Yet, the most recent of these studies analyzes data from over a decade ago. As part of a larger research agenda this study provides the first look at how the geography of the U.S. banking industry has changed since 1990.

We explore three fundamental facets of the geography of the banking industry. First, we show that mergers and acquisitions have allowed banks to move their company headquarters from smaller cities to larger cities, consistent with the existence of agglomeration economies available to banking *companies*. Second, we show that bank branches have moved substantially farther away from bank headquarters, evidence that banking *organizations* have become less geographically centralized. Third, we show that – despite these changes and despite historic increases in the number of bank branches – the spatial density of *deposits* in the 50 largest metropolitan areas has remained remarkably stable over time. That is, banks appear to have opened new branches and/or re-deployed existing branches in response to changes in the spatial distribution households.

BANK HEADQUARTER LOCATIONS

We begin by examining the location of commercial bank headquarters, and whether these locations tended to change during the 1990s as banking organizations restructured to operate more efficiently in geographically deregulated banking markets. Existing studies of large nonbanking companies (e.g., Klier and Testa 2002) find that the share of headquarters located in large metropolitan areas

[2] Although these studies find evidence of differential spatial impacts of deregulation and technology, most studies assume that capital will flow across geographic boundaries without frictions. Whereas this assumption may be a useful construct in theoretical models, it is not true in practice: there is plentiful evidence that informational, regulatory, and cultural frictions have shaped the geography of the banking industry. Berger and Udell (1998), Berger, DeYoung, Genay, and Udell (2000), and DeYoung, Hunter, and Udell (2004) contain summaries and analysis of these phenomena.

has increased in recent years.[3] Given commercial banks' key role in providing credit, payments, investment, and other financial advice to headquarters of nonbanking companies, agglomeration economies should be strong for commercial banks, and as such one would expect banking companies to favor large cities for their headquarters operations at least as much as nonbanking companies.

DATA ON HEADQUARTER LOCATIONS

Information on the location and characteristics of publicly held and actively traded banking and nonbanking companies comes from Compustat for the years 1990 and 2000.[4] The database identifies a company's headquarter location, its total employment, and total assets held domestically as well as assets held abroad. To identify gross flows of headquarters between different geographic locations, we used Compustat's "mergertracker" data to obtain detailed records on individual corporate actions such as mergers, companies going private, companies entering bankruptcy. Compustat records the headquarter address of target and acquirer at the time of the merger. We make the reasonable assumption that the headquarters remain at the acquiring company's address. We aggregate headquarter locations by metropolitan areas, specifically by the so-called consolidated metropolitan statistical area (CMSA).[5] Thus, our findings will not be affected by relocations of headquarters from a central city to a suburban location within the same metropolitan area. The underlying assumption is that a metropolitan area's different locales share common attributes relevant to the siting of headquarters, such as hub airports, access to business service firms, and a common skilled labor pool.

We focus on the headquarter locations of publicly traded U.S. depository institutions (SIC industry 60), the vast majority of which are commercial bank holding companies. Although only a small percentage of commercial banking companies are publicly traded, this small portion of banking companies holds the majority of total industry assets.[6] In 1990 there were just 197 publicly traded commercial

[3] Klier and Testa (2002) also find a changing distribution of company headquarters within large metropolitan areas. Within the 50 most populous MSAs, the middle tier of cities experienced a net gain in the number of large company headquarters during the 1990s, while the upper tier of cities experienced a net loss.

[4] The data represent a panel of all public companies whose shares are traded in the United States, with the exception of American Depositary Receipts (ADRs), closed-end mutual fund index shares, and pre-Financial Accounting Standards Boards (FASB) companies. Active companies are either publicly traded companies or are required to file with the Securities and Exchange Commission. Compustat created "pre-FASB" company records upon introduction of FASB rule 94 regarding the accounting of financial service subsidiaries to show consistency between current and historical data.

[5] For example, the Chicago CMSA encompasses the primary metropolitan statistical areas (PMSAs) of Chicago, IL, Gary, IN, Kankakee, IL, and Kenosha, WI.

[6] Although it is difficult to measure the output of commercial banks, total assets provide a rough and ready measure. Between 85 and 90% of aggregate industry assets are typically "intermediated," that is, lent out to companies or invested in securities issued by companies and governments.

banking companies in the United States, and these firms held approximately 84% of industry assets. The number of publicly traded banking companies increased dramatically during the 1990s as hundreds of mid-sized banking companies went public, taking advantage of a rising stock market to raise the funds needed to expand via acquisition. By 2000 there were 636 publicly traded banks. These publicly traded firms, however, still accounted for less than 10% of the population of commercial banking companies in the United States.

Table 1 shows two divergent trends for publicly traded banking companies during the 1990s. First, the average publicly traded banking company was substantially smaller by the end of the decade. Employment at the median publicly traded bank fell considerably, from 2,600 full-time equivalent employees (FTEs) in 1990 to just 240 FTEs in 2000, clear evidence of the hundreds of initial public offerings made by relatively small banking companies. Second, only 74 of the 197 banking companies in the 1990 data survived until 2000, but these "surviving" firms grew substantially larger during the decade. Average employment at surviving banks increased from 6,000 to 15,700 FTEs, and median employment rose from 2,600 to 6,600 FTEs. Employment at the largest surviving banking company increased by 64%, from 95,000 to 156,000 FTEs. These data illustrate the dramatic change in industry structure caused by scores of mergers and acquisitions (M&As) that combined large banking companies.

FINDINGS ON HEADQUARTER LOCATIONS

The raw headquarters data displayed in Table 2 indicate that the U.S. commercial banking industry became more spatially concentrated during the 1990s, somewhat consistent with developments in both the general U.S. population and nonbanking companies in the United States. These raw location data reflect two separate deregulation-induced changes in the banking industry: headquarters movements of large, established banking companies from smaller MSAs to larger MSAs, and a wave of initial public offerings by small, fast-growing banking companies located in small MSAs and rural markets.

In 1990 both banking companies and nonbanking companies are more spatially concentrated than the overall population, reflecting agglomeration economies that lead corporations to locate their headquarters in urban areas. For example, 71% of the U.S. population resided in the 50 largest MSAs in 1990, while approximately 85% of publicly traded bank and nonbank corporate headquarters were located in the 50 largest MSAs.

Moreover, bank and nonbank headquarters were distributed similarly within the largest MSAs in1990: the New York CMSA was home to 14% of bank headquarters and 18% of nonbank headquarters, and the largest five MSAs contained 35% of bank headquarters and 38% of

Table 1
Employment (in thousands of jobs) at publicly traded banking companies

	1990	2000	
		publicly traded banking companies that survived from 1990	*all publicly traded banking companies*
Mean	6	15.7	2.36
Median	2.6	6.6	0.24
Maximum	95	156	156
Observations	197	74	636
Firms not reporting	19	4	57

Source: Compustat.

Table 2
Distribution of U.S. Population, Company Headquarters, and Banking Industry Assets, 1990 and 2000.

	U.S. Population		Publicly traded bank headquarters			Publicly traded non-banking company headquarters		All traded and non-traded commercial banking companies		Total commercial banking industry assets	
	1990	2000	1990	2000		1990	2000	1990	2000	1990	2000
				companies that survived	*all companies*						
% in top 50 MSAs	71	72	86	88	56	84	87	31%	33%	83%	87%
% in other MSAs	9	8	14	12	25	5	3	17%	17%	10%	8%
% in rural locations	20	20	0	0	19	11	10	52%	50%	7%	5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Observations (#)	--	--	197	74	636	6335	7430	10461	7606	--	--
memo:											
% in New York CMSA	10%	9%	14	18	9	18	14	5%	5%	33%	29%
% in top 5 CMSAs	28%	27%	35	41	24	38	38	12%	12%	52%	41%

Sources: Census; Compustat; Call Reports.

nonbank headquarters. Not surprisingly, nonbanking companies were much more likely to be headquartered outside of MSAs than banking companies: one of ten nonbank headquarters were located in rural areas in 1990 compared to less than ½ percent of the bank headquarters.

Both the distribution of U.S. population and the distribution of

nonbanking company headquarters show evidence of gradual urbanization during the 1990s. By 2000 a greater percentage of the population and the nonbanking headquarters were located in the 50 largest MSAs, while smaller percentages were located in rural areas. However, there is some evidence of "de-urbanization" in the raw banking headquarters data. At the end of the decade only 56% of banks were headquartered in the 50 largest MSAs (vs. 86% at the beginning of the decade). At the same time, the share of bank headquarters in rural locations jumped from close to zero to 19%, and the share of headquarters located in smaller MSAs[7] increased from 14% to 25%.

These large changes in the spatial distribution of banking headquarters reflect the tremendous upheaval in the structure of the banking industry during the 1990s. Table 3 shows that 123 of the original 197 banks exited the publicly traded database (96 were acquired by another banking company, while 27 either failed or went private) and 562 new publicly traded banks entered the database (initial public offerings made by existing, privately held banks). The locations of these "new entrants" are driving the change in the spatial distribution of banking headquarters. Only 52% of the newly traded banks were located in the 50 largest MSAs, compared to 84% and 88% for exiting banks and surviving banks, respectively.

The newly traded banking companies were quite different in size (smaller), location (more rural), and business strategy (community banking) from the established banking companies, and their large numbers obscure the increase in urbanization among large, established banking companies in the overall data. Only 74 of the original 197 publicly traded banking companies still existed in 2000, but these "surviving" banks did not de-urbanize. As shown in Table 2, the percentage of surviving publicly traded banking companies with headquarters in the 50 largest metropolitan areas increased from 86% to 88% during the 1990s. Similarly, the percentage of all (traded and nontraded) banking company headquarters in the 50 largest MSAs increased from 31% to 33%, and the percentage of total banking industry assets held by these banking companies increased from 83% to 87% during the decade. The increase in the headquarters urbanization of large, established public banking companies was strongest in the largest urban markets. The share of these firms headquartered in the New York CMSA increased from 14% to 18% and the share located in the five largest CMSAs (including New York) increased from 35% to 41%.

That is to say, large public banking companies urbanized more intensively during the 1990s than did public nonbank companies.

[7] In the year 2000, MSAs of population rank 51 and lower represent populations of less than a million.

Table 3
Gross Flows of Bank Headquarters.

	Exit	Entry	Survive
% in top 50 MSAs	84	52	88
% in other MSAs	16	27	12
% in rural locations	0	22	0
Total	100%	100%	100%
Observations (#)	123	562	74
memo:			
in New York CMSA	12	8	18
in top 5 CMSAs	33	22	43

Source: Compustat.

Table 4
Acquisition Matrix for Publicly Traded Banking Companies.
MSA/CMSA Ranking Based on Population.

		Move In							
		NYC CMSA	CMSA 2-10	MSA 11-20	MSA 21-30	MSA 31-40	MSA 41-50	Other MSAs	Elsewhere
Move Out	NYC CMSA	**3**	2	0	0	0	0	0	0
	CMSA 2-10	1	**9**	2	1	1	1	1	0
	MSA 11-20	1	4	**6**	2	1	1	4	0
	MSA 21-30	2	0	1	**3**	0	0	0	0
	MSA 31-40	1	6	3	1	**2**	7	4	0
	MSA 41-50	0	0	2	0	0	**1**	0	0
	Other MSA	0	0	0	0	1	0	**0**	0
	Elsewhere	5	6	2	3	0	1	4	**1**

Source: Compustat

This pattern of intense urbanization among the very largest banking companies has continued into the 2000s, e.g., with Bank One moving its headquarters from Chicago to New York after being acquired by JPMorganChase in 2004. (In contrast, banking company assets have not become further concentrated in the 5 largest CMSAs. Two technical factors that occurred during the 1990s are the likely cause of this contrast. First, much of the growth at the largest New York City banking companies was due to "off-balance-sheet" activities such as investment banking, securities brokerage, and financial consulting which generate revenues but very few assets. Second, a small number of bank mergers moved the headquarters of very large banking companies out of

the top 5 CMSAs category and into the next lower tier of MSAs.)

The vast majority of headquarter relocations among large, established banking companies were driven by M&As. Table 4 is a transition matrix that shows the geographic disposition of these merger-induced relocations for publicly traded banking companies, while Table 5 shows the same thing for M&As of publicly traded nonbanking companies (see also Diacon and Klier, 2003). These transition matrices are divided into three areas: the shaded cells on the diagonal contain the number of M&As between two companies located in similar-sized MSAs; cells above the diagonal contain the number of M&As in which the acquired company headquarters moved from a larger to a smaller MSA; and cells below the diagonal contain the number of M&As in which the acquired company headquarters moved from a smaller to a larger MSA. Of the 96 banking company mergers shown in Table 4, 26% involved two banks located in similar size MSAs, 28% moved the acquired bank headquarters to a smaller MSA, and 46% moved the acquired bank headquarters to a larger MSA. For the 732 nonbanking company mergers shown in Table 5, these percentages were 30%, 40%, and 30%, respectively. These data indicate that M&As during the 1990s resulted in decreased urbanization of publicly traded nonbanking companies. But in the banking industry, restructuring in the aftermath of geographic deregulation, M&As resulted in greater urbanization.

BRANCH LOCATIONS RELATIVE TO THEIR MAIN OFFICES

While large banking companies were exploiting deregulation to participate in M&As that relocated their headquarters to larger urban areas, banks of all sizes were exploiting deregulation to open branch offices in new geographic markets. Figure 1 shows the changes in the number of branch offices and branch offices per bank since 1980. Most of these 27,000 new branches were brand new, or "de novo," offices, while many (exact figures are not available, but substantially less than 10,000) were simply conversions of existing head offices of acquired banks into "new" branches.

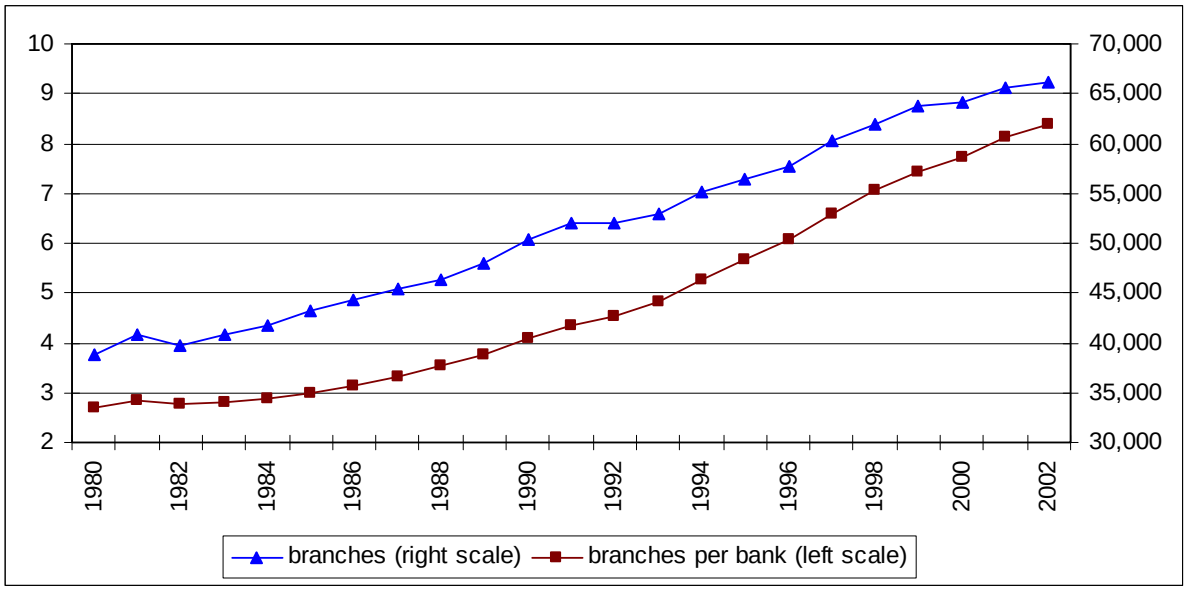
The geographic distribution of these new branches relative to the bank headquarters locations is not well understood, and could be affected by several factors. As discussed above, deregulation allowed banks to have a wider geographic footprint, so many of the new branches will certainly be farther away from the head office. Moreover, there is evidence that improvements in information technology (e.g., computers, fax machines, credit databases) and risk management (e.g., credit derivatives, asset securitization) have allowed senior headquarters management to better monitor branch loan officers at longer distances (e.g., Berger and DeYoung 2001, 2002), making geographic expansion via branching more feasible.

Table 5
Acquisition Matrix for Publicly Traded Non-Banking Companies.
MSA/CMSA Ranking Based on Population.

		Move In							
		NYC CMSA	CMSA 2-10	MSA 11-20	MSA 21-30	MSA 31-40	MSA 41-50	Other MSAs	Elsewhere
Move Out	NYC CMSA	**31**	24	8	9	2	0	6	16
	CMSA 2-10	44	**115**	22	16	11	15	23	60
	MSA 11-20	16	36	**30**	5	7	3	11	15
	MSA 21-30	4	16	6	**12**	1	2	3	4
	MSA 31-40	0	13	6	1	**5**	4	7	4
	MSA 41-50	4	7	4	1	0	**2**	4	4
	Other MSA	3	21	13	2	4	5	**18**	9
	Elsewhere	1	1	3	2	0	1	5	**5**

Source: Compustat

Figure 1
Branches and Branches per Bank in U.S. Commercial Banking Industry, 1980-2002.



Source: FDIC

However, a number of other studies conclude that improved technology has also allowed branch loan officers to better evaluate the creditworthiness and monitor the performance of borrowers at longer distances (e.g., Cyrnak and Hannan 2000; Degryse and Ongena 2002; Petersen and Rajan 2002; Wolken and Rohde 2002), reducing (at least at the margin) the necessity for banks to expand geographically in order to grow. Similarly, the explosion of ATMs and increased use of Internet banking reduces the need for banks to operate branches close to household

depositors. Finally, to the extent that within-market bank mergers have reduced competition in some markets, there may be less incentive for banks to compete by providing more branch locations.

DATA ON BANK-TO-BRANCH DISTANCE

A full investigation of the various determinants of bank-to-branch distance is well beyond the scope of this study; as a first investigation in this area, we will simply measure and analyze the net changes in bank-to-branch distance during the past decade. We use the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits database, along with the Federal Reserve Bank of Chicago Call Report database, to find the five-digit Zip Codes for all full-service offices of U.S. commercial banks in 1994 and 2003 that had main offices located in MSAs.[8] We then use *Maptitude* geographic mapping software to measure the distance in miles between (a) the Zip Code centroid of each branch and its main office, and (b) the Zip Code centroid of each branch and the CBD of its main office's MSA. We analyze the former in this section, and the latter in the section that follows.

[8] The earliest and most recent years for which high quality electronic data for branch locations is available are 1994 and 2003, respectively. We use MSAs to define markets (rather than the larger CMSAs) because even in 2003 the majority of U.S. commercial banks have local business strategies. Furthermore, unlike the analysis in the previous section, our analysis here is not concerned with movements of head offices into, out of, or within metropolitan areas.

FINDINGS ON BANK-TO-BRANCH DISTANCE

Table 6 displays the average distances between the main offices of commercial banks and their branches in 1994 and 2003 and how these average distances changed during these ten years. In all cases displayed in the table – mean distances, median distances, branches within the same MSA as the main bank office, and all branches associated with the main bank office – the average branch-to-bank distance increased by a statistically significant amount between 1994 and 2003. The increase in mean within-MSA distance displayed in the top panel is just 1.2 miles, an increase of approximately 12%. Given that the transportation time of covering an additional 1.2 miles is minimal, this small increase in branch-to-bank distance is unlikely to be economically significant.

However, restricting the analysis to branches within the same MSA as their main office substantially understates the increase in the geographic scope of banking companies, because deregulation freed banking companies to operate in multiple geographic markets. As shown in the bottom panel of Table 2, relaxing this same-MSA constraint paints a different picture. The mean increase in branch-to-bank distance including the multiple-MSA banking companies is nearly 24.55 miles, an increase in distance of slightly over 80%. This is clearly an economically significant difference: given the frictions involved with surface travel in urban areas, 24 miles as the crow

flies can easily translate into 45-to-60 minute of travel time.

These results suggest that between 1994 and 2003 the branching density (i.e., branches per square mile) *at the typical banking company* declined; the number of bank branches increased by approximately 20% during this time period (Figure 1) while the average distance between banks and their branches increased by over 80%. (Of course, *the aggregate branching density* in the United States increased during this time period, because the geographic area of the United States was constant between 1994 and 2003.)

BANKING ACTIVITY RELATIVE TO THE CENTRAL BUSINESS DISTRICT

Changes in the distance between banks and their branches have implications mainly for internal bank operations – that is, as branches are located farther from headquarters, can senior management monitor and control junior managers and loan officers? – and are not necessarily a good measure of the urban geography of the banking industry. As the industry continues to consolidate, an increasing number of bank branches are located in different metropolitan areas than their headquarters.

Table 6

Distance (in miles) between geographic location of branches and main bank offices for urban commercial banks in U.S. in 1994 and 2003.

	1994 mean (standard deviation)	**2003** mean (standard deviation)	**difference** difference in means (t-statistic)
Branches within same MSA as main bank office (12,581 branches)			
mean distance	9.97 (5.02)	11.17 (4.83)	1.20*** (3.02)
median distance	8.86 (5.08)	10.04 (4.68)	1.18*** (7.58)
# of MSAs	307	306	
All branches associated with the main bank office (33,678 branches)			
mean distance	29.78 (38.76)	54.33 (91.29)	24.55*** (4.37)
median distance	21.00 (31.34)	37.51 (83.62)	16.15*** (3.26)
# of MSAs	312	311	

Moreover, the main office of a banking company need not be located in the CBD, the traditional urban center and the place where agglomeration economies are presumably highest. Hence, we turn to our second distance measure – the distance between metropolitan bank branches and their CBDs – to analyze changes in the urban geography of the U.S. banking industry between 1993 and 2003.

THE DISTRIBUTION OF DEPOSITS-PER-BRANCH AROUND THE CBD.

We estimate the density of bank branches based on the following functional form and ordinary least squares (OLS) techniques:

$$ln(\text{deposits per branch}_i) = \alpha + \beta * \text{branch distance to the CBD}_i + \varepsilon_i \quad (1)$$

The dependent variable is the natural log of deposits in branch *i*; thus, we are estimating a branch density function weighted by deposits. The explanatory variable is the straight line distance between branch *i* and the central business district of its MSA.[9] The estimated coefficients α and β describe the density of bank branches (weighted by deposits) around the CBD, and estimating these coefficients separately for both 1994 and 2003 data allows us to test whether the geographic distribution of branch banking changed during the past decade.

Our data set includes all bank branches within 70 miles of the CBDs of the 50 most populous U.S. metropolitan areas. Summary statistics for the regression variables are displayed in Table 7. We adjusted 1994 deposit data for changes in the price level and the size of the real economy between 1994 and 2003.[10] Thus, any changes in deposits per branch reflected in the estimates of α and β will be purged of the effects of economic growth and inflation.

Table 8 displays the estimated parameters of (1) for both 1994 and 2003. In both years, branch size declines slightly with distance from the CBD. In 1994 deposits per branch fell by 1.1% with each additional mile from the CBD, and fell by 1.0% per mile in 2003; this difference in gradients is not statistically significant. However, the intercept falls from 10.591 in 1994 to 10.337 in 2003, and this change is highly significant. This downward, parallel shift in the deposit-distance relationship implies that the average bank size is smaller in *all* locations. This parallel shift translates into an economically meaningful reduction in deposits of $8.9 million per branch, or about a 22% reduction per branch, which is roughly consistent with the 25.5% increase in the number of branches during these ten years. This implies that banks packed the urban geographic space more tightly with bank branches during the decade.

[9] The geographic coordinates for the zip code centroids and the CBDs come from the Maptitude GIS program. The distance between these two sets of coordinates is given by the following formula: acos(sin(la1)*sin(la2) + cos(la1)*cos(la2)*cos(lo2-lo1))*6370*.62, where la1 and lo1 are the latitude and longitude (in radians) of the zip code centroid and la2 and lo2 are the coordinates for the CBD.

[10] We multiplied 1994 deposits by ratio of nominal U.S. GDP in 2003 and 1994: $10,847/$7,031 = 154.28%.

THE DISTRIBUTION OF DEPOSITS-PER-SQUARE-MILE AROUND THE CBD

The evidence above suggests that the deposit-weighted density of bank branches in U.S. metropolitan areas fell during the 1990s chiefly due to a change in strategic bank behavior – increased spatial density of branches within the MSA – and not because of any change in the density of urban or suburban deposits. However, drawing such a conclusion based on the above analysis alone requires us to draw some strong inferences. To increase our confidence in this conclusion, we more carefully explore the spatial distribution of banking activity by estimating the density of deposits in the same metropolitan areas. Our initial deposit density function is a slight variant of equation (1):

$$ln(\text{deposits per square mile}_j) = \alpha + \beta * \text{distance to the CBD}_j + \varepsilon_j \quad (2)$$

This is a direct analog to standard methods used by urban economists to study urban population density functions (McDonald, 1989). The dependent variable is the total deposits in all branches i located in zip code j, divided by the geographic area of zip code j in square miles. As a complement to the standard negative exponential functional form in (2), we also estimate the deposit density function using a more flexible cubic spline functional form (Suits, Mason, and Chan 1978):

$$ln(\text{deposits per square mile}_j) = \alpha + \beta_1 * d_j + \beta_2 * (d_j^2/10) + \beta_3 * (d_j^3/100) + \gamma_1 * (d_j>10) * (d_j-10)^3 + \gamma_2 * (d_j>20) * (d_j-20)^3 + \gamma_3 * (d_j>30) * (d_j-10)^3 + \gamma_4 * (d_j>40) * (d_j-20)^3 + \gamma_5 * (d_j>50) * (d_j-60)^3 + \gamma_6 * (d_j>60) * (d_j-60)^3 + \varepsilon_j \quad (3)$$

which supplements a simple cubic specification with additional variables that allow the function to vary smoothly with distance from the CBD, where d_j is the distance between zip code j and the CBD, and $(d_j>x)$ is a dummy equal to 1 for zip codes that are more than x miles from the CBD.

The estimated parameters of the negative exponential (2) and the cubic spline (3) regressions are reported in Table 9. The gradient for the deposit density functions is much steeper than the gradient for the branch density functions: the simple regression (2) implies that deposits fell by 10.2% and 9.8%, respectively, with each additional mile from the city center between 1994 and 2003. The difference in these two gradients is not statistically different, but the difference in the estimated intercepts is statistically significant. This intercept shift – which translates into $9,084 per square mile, a 12.9% reduction over the ten years – is likely a result of the inflexible functional form used in (2). When we re-estimate using the cubic spline we find that the spatial distribution of deposits remained remarkably similar across time. Although most of the coefficients in the cubic spline are statistically significant, none of the coefficients are statistically different from each other across time, and the joint change in all the coefficients is also insignificant. Thus, once we

allow for additional nonlinearity, the regressions indicate that there was no change between 1994 and 2003 in the spatial distribution of deposits within metropolitan areas. This similarity is illustrated in Figure 2, which graphically depicts the estimates of both the negative exponential and cubic spline regressions.

The deposit densities are also similar when estimated separately for each of the 50 metropolitan areas. Figure 3 shows the estimated distance gradient from the negative exponential form (2) for each metropolitan area in both 1994 and 2003. The gradients are ordered by their 1994 value. The average gradient is 11.6% in 1994 and

Table 7

Summary Statistics for Variables used in Equations (1) and (2). Means and (standard deviations). Dollar figures are in thousands of real, growth-adjusted 2003 dollars. Distance to the CBD is measured from the centroids of the zip codes in which the banks are located.

	1994	2003
Variables for equation (1)		
deposits per branch	$65,359.68 (267,697.67)	$66,205.23 (667,517.10)
ln(deposits per branch)	$10.454 (1.142)	$10.206 (1.282)
branch distance to the CBD	13.022 (10.910)	13.672 (10.871)
number of branch observations	32,834	41,196
Variables for equation (2)		
deposits per zip code	$294,951.34 (1,100,003.28)	$398,613.27 (2,369,913.63)
zip code area (square miles)	28.16 (50.18)	28.16 (50.18)
ln(deposits per square mile)	9.39 (2.19)	9.31 (2.21)
zip code distance to the CBD	17.74 (13.02)	17.74 (13.02)
number of zip code observations	4,508	4,923

Source: FDIC Summary of Deposits, Chicago Fed Call Reports, *Maptitude*, and authors' calculations.

11.3% in 2003 – the same trend but slightly different values than those presented in Table 8. In 1994, the estimates range from 4.1% in Greensboro-Winston-Salem NC to 20.4% in Miami FL. The estimates range from 4.1% to 18.9% in 2003, with the same two cities at the extremes. Figure 4 shows the change in gradients (again, using the negative exponential form) for each of the 50 metropolitan areas. A positive change implies that the estimated deposit density function became steeper between 1994 and 2003. For most cities the gradient changes very little over time – the average change in gradients is only -0.28% – and positive changes were nearly as common as negative changes. The only metropolitan areas with statistically significant changes in the estimated gradients are Detroit MI (9.4% in 1994 and 8.5% in 2003) and Philadelphia PA (10.1% in 1994 and 8.9% in 2003). Whether we use a single equation to represent all metropolitan areas or a separate equation for each city, the results are the same: the geographic distribution of branch deposits did not change significantly between 1994 and 2003 within the 50 most populous metropolitan areas.

CONCLUSIONS

The commercial banking industry in the United States offers a unique opportunity to study the effects of regulatory and technological change on the geography of urban economic activity. Over a relatively short period of time, over 50 years of regulatory

Table 8

Deposits-per-Branch Density Functions, Equation (1).Combined data for 50 largests MSAs.

	1994	2003	Difference in Coefficients
Constant	10.591* (0.010)	10.337* (0.010)	-0.254* (0.014)
Branch Distance to CBD	-0.011* (0.001)	-0.010* (0.001)	0.001 (0.001)
R^2	0.010	0.001	
F-Test , constant coefficients across years			359.69*
Number of Observations	32,834	41,196	

Note. The dependent variable is the natural logarithm of deposits for individual branch banks. Standard errors are in parentheses. "*" and "**" indicate statistical significance at the 5% level and 10% levels.

restrictions to the geographic growth of commercial banks were removed. At around the same time, new technology in communications, information, and financial markets increased the ability of banks to manage credit relationships at increased distances from bank headquarters. This study provides a first step in a larger research agenda by describing how the geography of the U.S. banking industry has changed in response to deregulation and technological advance.

We explore three fundamental facets of the geography of the banking industry – headquarters locations, branch office locations, and deposit collection – and how these changed during the 1990s. We find that mergers and acquisitions have allowed banks to move their company headquarters from smaller cities to larger cities, consistent with the existence of agglomeration economies available to banking companies. Banks that went public during the 1990s, however, are nearly 4 times as likely as surviving public banks to be located in smaller MSAs or in rural areas. We demonstrate that bank branches have moved substantially farther away from bank headquarters, evidence that banking organizations have become less geographically centralized. And, despite the fact that the number of branches increased by 25%, we show that the spatial density of deposits in the 50 largest metropolitan areas has remained remarkably stable over time.

ENDNOTE

The opinions expressed in this study are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Chicago or the Federal Reserve System.

REFERENCES

Berger, A.N. & DeYoung, R. 2001 The Effects of Geographic Expansion on Bank Efficiency. *Journal of Financial Services Research* 19:163-184.

Berger, A.N. & DeYoung, R. 2002 The Technological Progress and the Geographic Expansion of the Banking Industry. Federal Reserve Bank of Chicago Working Paper WP 2002-07.

Berger, A.N. & DeYoung, R. & Genay, H. & and Udell, G.F. 2000 The Globalization of Financial Institutions: Evidence from Cross-Border Banking Performance. In *Brookings-Wharton Papers on Financial Services*, edited by R. Litan and A. Santomero, Vol. 3, pp. 23-125. Washington: Brookings Institution Press.

Berger, A.N. & Udell, G.F. 1998 The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle. *Journal of Banking and Finance* 22:613–73.

Cyrnak, A. & Hannan, T.H. 2000 Non-Local Lending to Small Businesses Federal Reserve Board working paper.

Degryse, H. & Ongena, S. 2002 Distance, Lending Relationships and Competition Working paper, Tilburg University.

DeYoung, R. & Hunter, W.C. & Udell, G.F. 2004 The Past, Present, and Probable Future for Community Banks. *Journal of Financial Services Research* 25(2/3), forthcoming.

Diacon, T. & Klier, T.H. 2003 Where the Headquarters are – Evidence from Large Public Companies 1990-2000. Federal Reserve Bank of Chicago Working Paper WP 2003-35.

Furst, K. & Lang, W.W. & Nolle, D.E. 2002 Internet Banking. *Journal of Financial Services Research* 22:95-117. Holly, B. 1987 Regulation, competition and technology: the restructuring of the US commercial banking system. *Environment and Planning A* 19:633-652.

Klier, T. & Testa, W. 2002 Location trends of large company headquarters during the 90s. *Economic Perspectives*, Federal Reserve Bank of Chicago, Vol. XXVI (2):12-26.

Lord, J.D. 1992 Geographic Deregulation of the US bankign industry and spatial transfers of corporate control. *Urban Geography* 13:25-48.

McDonald, J. F. 1989 Econometric Studies of Urban Population Density: A Survey. *Journal of Urban Economics* 26:361-395.

Petersen, M.A. & Rajan, R.G. 2002 The Information Revolution and Small Business Lending: Does Distance Still Matter? *Journal of Finance* 57:2533-2570.

Suits, D. & Mason, A. & Chan, L. 1978 Spline Functions Fitted by Standard Regression Methods. *Review of Economics and Statistics* 60:132-139.

Wolken, J.D. & Rohde, D. 2002 Changes in the Location of Small Businesses' Financial Service Suppliers between 1993 and 1998. Federal Reserve Board internal memorandum.

Zhou, B. 1998 Geographical patterns of interstate banking: A snapshot of the US metropolitan system in the early 1990s. *Urban Geography* 19:24-48.

Figure 2
Estimated Deposit Density Functions

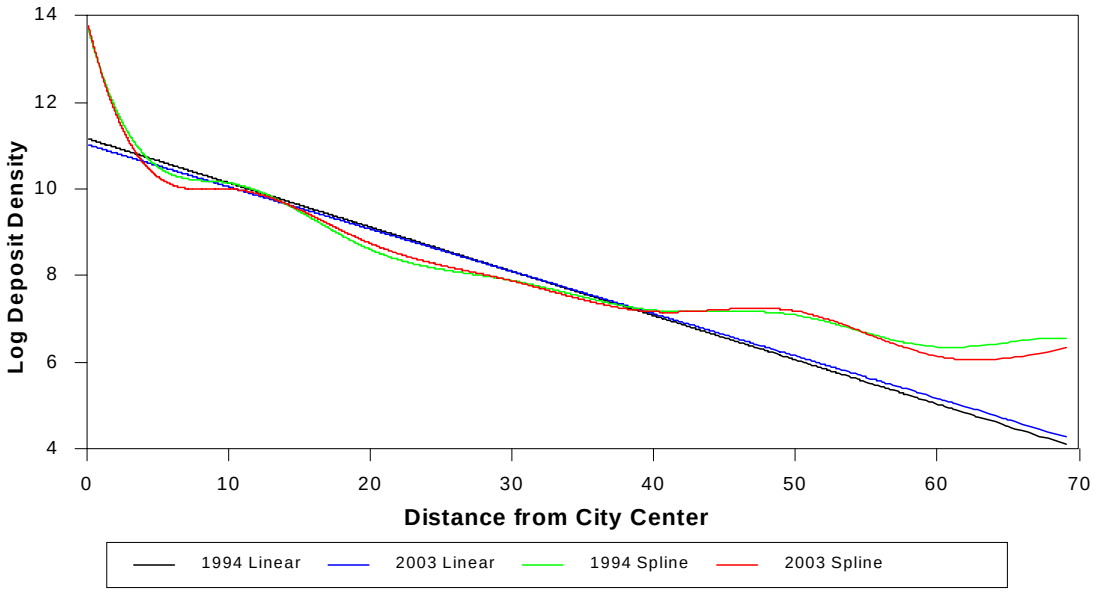


Table 9

Deposits-per-Square-Mile Density Functions. Combined data for 50 Largest MSAs.

	Negative exponential (2)			Cubic Spline (3)		
	1994	2003	Difference in Coefficients	1994	2003	Difference in Coefficients
Constant	11.163* (0.043)	11.025* (0.044)	-0.138* (0.062)	13.781* (0.163)	13.877* (0.170)	0.096 (0.236)
Zip Code Distance to CBD	-0.102* (0.002)	-0.098* (0.002)	0.005 (0.003)	-1.211* (0.084)	-1.343* (0.087)	-0.132 (0.121)
$d^2/10$				1.380* (0.121)	1.538* (0.124)	0.159 (0.173)
$d^3/100$				-0.533* (0.050)	-0.583* (0.051)	-0.050 (0.072)
$(d-10)^3 x(d>10)$				0.649* (0.066)	0.684* (0.068)	0.034 (0.095)
$(d-20)^3 x(d>20)$				-0.176* (0.036)	-0.143* (0.036)	0.033 (0.050)
$(d-30)^3 x(d>30)$				0.104* (0.039)	0.087* (0.039)	-0.017 (0.056)
$(d-40)^3 x(d>40)$				-0.104** (0.055)	-0.123* (0.056)	-0.019 (0.079)
$(d-50)^3 x(d>50)$				0.137 (0.102)	0.167 (0.104)	0.030 (0.146)
$(d-60)^3 x(d>60)$				-0.170 (0.438)	-0.129 (0.467)	0.041 (0.641)
R^2	0.370	0.326		0.427	0.377	
F-Test , constant coefficients across years			2.576**			1.432
Number of Observations	4508	4923		4508	4923	

Figure 3
Estimated Gradients

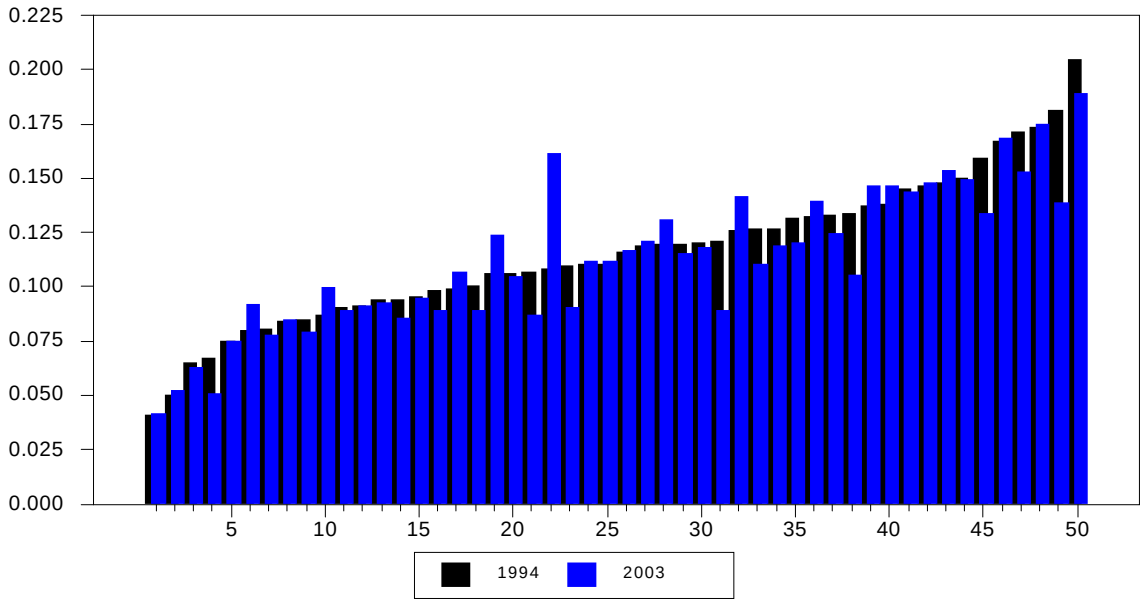


Figure 4
Change in Estimated Gradients from 1994 to 2003