The Effects of Geographic Expansion on Bank Efficiency

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Abstract

We assess the effects of geographic expansion on bank efficiency using cost and profit efficiency for over 7,000 U.S. banks, 1993-1998. We find that parent organizations exercise some control over the efficiency of their affiliates, although this control tends to dissipate with distance to the affiliate. However, on average, distance-related efficiency effects tend to be modest, suggesting that some efficient organizations can overcome any effects of distance. The results imply there may be no particular optimal geographic scope for banking organizations — some may operate efficiently within a single region, while others may operate efficiently on a nationwide or international basis.

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The banking industry is consolidating around the globe in response to regulatory changes and other factors. The U.S. banking structure has not yet fully adapted to the Riegle-Neal Act, which permits bank branching on almost a nationwide basis, and the Gramm-Leach-Bliley Act, which permits relatively unrestricted universal banking powers for well-capitalized financial holding companies. In the European Union, the financial structure has not yet fully adapted to the Single Market Programme, which essentially allows continent-wide universal banking with a single license, and monetary union, which provides for a single currency for most of the continent. In Asia, consolidation is occurring in reaction to recent banking and financial crises. These changing factors, along with the globalization of financial markets in general, have also created opportunities for intercontinental financial organization mergers and acquisitions (M&As). In most cases, the consolidation activity involves geographic expansion – financial organizations expanding to other locations within their home regions; into other regions within their home nation; or into other host nations, any of which may be considerable distances away.

The purpose of this paper is to assess the effects of this geographic expansion on bank efficiency. On the one hand, geographic expansion may allow efficiently managed institutions to 'export' their superior managerial skills and policies and procedures to distant affiliates; take advantage of network economies; and exploit the benefits of geographic risk diversification. On the other hand, operating a far-flung banking empire may reduce efficiency as senior managers stray into markets in which they have less core competence; as organizational diseconomies arise (such as agency problems in monitoring junior managers in a distant locale); and as distance makes providing relationship-based services to local customers more difficult. We investigate these effects of geographic expansion on efficiency by addressing three related questions:

1) Can parent financial organizations control the efficiency of their affiliates by exporting their skills/policies/procedures, and does this control vary with distance to the affiliate?

2) Does the efficiency of an affiliate vary with its distance from its parent organization?

3) Are some individual financial organizations able to exercise more control and function more efficiently as geographically dispersed organizations than others?

It is important to distinguish between the concept of control and the level of efficiency. More control implies that the efficiency of affiliate banks will be more similar to the efficiency of the parent. That is, the controlling organization can export either high or low quality managerial skills/policies/procedures.

We address these questions by conducting three distinct empirical analyses -- a bivariate analysis, a regression analysis, and an individual organization analysis. Each of these analyses uses estimates of cost and profit efficiency for over 7,000 U.S. banks from 1993 to 1998. The data provide an excellent laboratory for analyzing the efficiency effects of geographic expansion because the U.S. is a geographically large nation with long distances between banks in the same bank holding company (BHC). Over this time period, banks were generally allowed to operate in only one state (although their parent BHCs could own banks in multiple states), so the location of the bank is a fairly good indicator of where it operated and achieved its efficiency scores. These data allow us to observe how well organizations control the efficiency of distant affiliates and whether affiliate efficiency varies with distance from the parent. Importantly, our observations are not confounded by differences in language, culture, currency, regulatory/supervisory structures, etc. that may plague studies of banks operating across international borders.

Our bivariate analysis compares the efficiency of banks located in the same geographic region as their parent organization, the efficiency of banks located in geographic regions contiguous to their parents, and the efficiency of banks located in regions that are not contiguous to their parents. We also compare the efficiency of home-region banks whose parent organizations own banks only in that same region, home-region banks whose parents own banks in contiguous regions, and home-region banks whose parents own banks in noncontiguous regions. Thus, we are able to see how geographic expansion into nearby and far away locations affects the efficiency of both distant affiliates and home-region banks. This analysis primarily addresses question (2) above about the relationship between distance and the level of efficiency.

Our regression analysis focuses on what determines the efficiency of affiliates in multibank holding companies. We regress affiliate bank efficiency on the efficiency of the lead bank in the BHC, the distance between the affiliate and the lead bank, and other variables. Our maintained assumption is that the senior management of the organization is located at the lead bank and that the performance of the lead bank is representative of the organization's skills, policies, and procedures. We use the coefficient on lead bank efficiency as an indicator of parental control; we use the coefficient on distance as an indicator of the effect of distance on affiliate efficiency; and we use the coefficient on the interaction of lead bank efficiency and distance to indicate the degree to which parental control varies with distance. This analysis addresses both questions (1) and (2) above about the effects of organizational control and distance on efficiency. We also estimate subsample regressions for affiliates located in different states than, in different regions from, and in regions noncontiguous to, their parents. By testing whether organizations that choose greater geographic scope tend to be those that are relatively good at exercising control at a distance, these regressions address question (3) above about whether some individual organizations are better at control and efficiency than others.

Our individual organization analysis focuses on the efficiency of individual banking organizations, as opposed to the bivariate and regression analyses, which focus on the efficiency of the average bank affiliate. We start by identifying all BHCs with 10 or more affiliates in our data. From that group, we identify "efficient BHCs" whose affiliates tend to operate with above-average efficiency regardless of where they are located – in the BHC's home state, in the BHC's home region, or in regions contiguous or noncontiguous to the BHC's home region. Finally, we check to see whether any one particular geographic strategy – such as statewide, regional, or superregional banking – is predominant among these efficient BHCs. This analysis primarily addresses question (3) above about whether some individual institutions are better at control and efficiency than others.

Of the three analyses, we put the greatest emphasis on the regression analysis because it is the most direct and comprehensive approach to addressing the three questions above. The bivariate and individual organization analyses shed additional light on questions (2) and (3), respectively, and corroborate the findings of the regression analysis.

The paper unfolds as follows. Section 1 reviews some previous research that has touched on the issues of control and distance. Section 2 discusses the efficiency advantages and disadvantages of geographic expansion. Section 3 explains how we measure bank efficiency and describes our data. Sections 4, 5, and 6 present the results of our bivariate, regression, and individual organization analyses, respectively, and explain how these results answer the three main research questions asked above. Section 7 provides brief concluding remarks.

1. Review of related research literature

To our knowledge, no prior research has directly addressed our three main questions about the effects of organizational control and distance on bank efficiency. Specifically, we know of no prior studies that have investigated affiliate efficiency as a function of the efficiency of the parent organization to assess the degree of organizational control; none that have measured distances between affiliates and parent organizations to assess the effect of distance on efficiency; and none that have examined the patterns of affiliate efficiency within individual banking organizations to see if some organizations are able exercise more control and function more efficiently as geographically dispersed organizations than others.

However, some prior research has come close to these issues. With respect to the control issue, there is some research on the effects of BHC affiliation on the efficiency of the organization as a whole. While efficiency of the organization is not the same concept as control, it would be expected that organizations in which senior management is able to exercise more control would also be more efficient, all else equal. The empirical results are mixed. For example, some studies found that banks in BHCs are more efficient than independent banks (e.g., Spong, Sullivan, and DeYoung 1995, Mester 1996). In contrast, other research suggested that branch banking organizations are more efficient than multibank BHCs (e.g., Grabowski, Rangan, and Rezvanian 1993), and that for a given organization size, a greater number of separate bank charters reduces the market value of the organization (Klein and Saidenberg 2000).

Some inference on the control issue may also be gleaned from the research on the efficiency of bank branches. If senior management is able to effectively control the operations of individual branches, then the efficiencies of the individual branches would be expected to be clustered near the performance of the best practice branch of the bank. If senior management is not in control, then the efficiencies of the individual branches would be expected to be widely dispersed. Studies of the branching networks of large U.S. banks (e.g., Sherman and Ladino 1995, Berger, Leusner, and Mingo 1997) and of a large Canadian bank (Schaffnit, Rosen, and Paradi 1997) found efficiencies almost as dispersed as those typically found in studies of unrelated banks, consistent with relatively weak control for the senior management of the bank. In contrast, a number of nonparametric efficiency studies that mostly used small numbers of branches (usually for European banks) typically found relatively tight distributions of branch efficiency, with mean efficiency exceeding .90 (e.g., Sherman and Gold 1985, Zenios, Zenios, Agathocleous, and Soteriou 1996, Parkan 1987, Oral and Yolalan 1990, Vassiglou and Giokas 1990, Giokas 1991, Al-Faraj, Alidi, and Bu-Bshait 1993, Pastor 1993, Tulkens 1993, Tulkens and Malnero 1994, Drake and Howcroft 1995, Athanassopoulos 1997, 1998). This last finding could reflect very tight managerial control over branch operations or it could alternatively reflect a problem with nonparametric methods that arises when the number of observations is relatively small.

Some research has examined the effects of geographic expansion within a nation of banking organizations as a whole and found generally favorable effects. Some found that larger, more geographically integrated institutions tend to have better risk-expected return frontiers (e.g., Hughes, Lang, Mester, and Moon 1996, 1999, Demsetz and Strahan 1997). Others found that banking organization M&As raise profit efficiency in a way consistent with the benefits of improved geographic diversification, but does not have much effect on cost efficiency (e.g., Berger and Humphrey 1992, Akhavein, Berger, and Humphrey 1997, Berger 1998). These studies generally found that the difference in efficiency between the acquirer and target had relatively little effect on overall efficiency improvement following consolidation, suggesting that the ability of acquirers to export superior skills/policies/procedures to targets may be limited. However, these studies did not examine the efficiency of the individual affiliates of the organizations, did not directly address the issue of intra-organizational control, and did not measure the distance from the parent organization.

Other research has examined efficiency across international borders, which is usually associated with significant geographic expansion. Most studies found that foreign affiliates in a host nation are less efficient on average than the domestic banks in that nation (e.g., DeYoung and Nolle 1996, Hasan and Hunter 1996, Mahajan, Rangan, and Zardkoohi 1996, Chang, Hasan, and Hunter 1998, Miller and Parkhe 1999, Parkhe and Miller 1999, Berger, DeYoung, Genay, and Udell 2000), while some found that foreign institutions have about the same average efficiency as domestic institutions (e.g., Vander Vennet 1996, Bhattacharya, Lovell, and Sahay 1997, Hasan and Lozano-Vivas 1998). These findings would appear to conflict with the within-nation results cited above, in which geographic expansion appeared to be favorable on balance. However, as noted above, cross-border expansion is also associated with other potential barriers to efficiency – such as differences in language, culture, currency, regulatory/supervisory structures – which are difficult to disentangle from the effects of geographic expansion in these studies.

Some of the cross-border studies implicitly addressed the issue of control by studying the effects of the identity of the home nation of the parent organization. The limited findings suggested that the foreign affiliates with parent organizations in the U.S. tended to be more efficient (e.g., Berger, DeYoung, Genay, and Udell

2000), and that efficiency was higher when the home nation and host nation had more similar economic environments (e.g., Miller and Parkhe 1999, Parkhe and Miller 1999). The first result is consistent with the possibility that some home nation market or supervisory/regulatory conditions in the U.S. may aid in the control of foreign affiliates. The second result is consistent with the possibility that having similar market or supervisory/regulatory conditions in the home and host nations may aid in the control of foreign affiliates.

2. The efficiency advantages and disadvantages of geographic expansion

The removal of intrastate and interstate geographic restrictions on competition in the U.S. has increased the freedom of banking organizations to expand geographically and potentially move towards a more efficient structure. Geographic expansion allows senior management of efficient organizations to spread their best practices over more resources. As stressed above, these efficiency improvements occur when efficient organizations are the ones expanding, and whether such efficiency transfers are successful depends on management's ability to control events at a distance. These gains in managerial efficiency, or X-efficiency, may accrue in the form of lower costs of producing a given bundle of financial services, or in the form of higher revenues from producing or packaging financial services that are more highly valued by customers, or both.

Geographic expansion may also allow scale or scope efficiencies that reduce costs or enhance revenues. Linking branches, ATMs, and back-office facilities over a larger geographic area may yield network economies. A more geographically broad institution may also be better able to serve business customers that have many locations, and may have a broader menu of potential new investment opportunities outside its home market.

In addition, geographic expansion can diversify banking organizations across different regional economic environments, reducing the variation in the organizations' earnings over time. This can add value by improving the organization's risk-expected return frontier, allowing the bank to increase its average revenues by adopting a higher risk, higher expected return investment strategy. A reduction in risk from diversification may also increase the value of the institution’s financial guarantees (loan commitments, letters of credit, derivative contracts) and its capacity to issue them. On the cost side, greater diversification may reduce the organization's cost of capital by allowing it to pay lower rates on uninsured deposits and other contingent liabilities. The costs of complying with prudential supervision and regulation may also be reduced.

To provide some insight into the potential benefits from geographic diversification, Table 1 gives information about the distribution of bank earnings across geographic regions in the U.S. The table shows the mean return on equity (ROE) for commercial banks located in the eight Bureau of Economic Analysis (BEA) regions of the U.S. and the correlation of ROE across these regions over the period 1979-1998. These data suggest very strong diversification possibilities from cross-regional consolidation. Bank earnings in many region-pairs have fairly low correlations, including one negative correlation. Eight of the ten weakest correlations are between noncontiguous region-pairs, while seven of the ten strongest correlations are between contiguous region-pairs -- indicating that banks have an incentive to expand beyond contiguous regions into noncontiguous regions to capture additional diversification gains.

While geographic expansion is associated with a number of potential efficiency advantages, geographic expansion can also potentially reduce efficiency. Geographic expansion by inefficiently managed banks may spread inferior management practices over a greater amount of resources. As well, otherwise competent managers may stray into new geographic markets for which they lack relevant local knowledge, or into markets that require skills that lie outside these managers' areas of core competence. Holding managerial ability constant, geographic expansion could also result in scale or scope inefficiencies because managing a larger, more far-flung empire is more difficult. Organizational diseconomies may arise because senior managers at the headquarters cannot easily monitor managerial effort, service quality, or economic conditions at the local level -- that is, there may be significant agency costs in trying to control junior management at a distant locale. As discussed below, providing and monitoring relationship-based small business loans may be especially difficult at a distance because of problems in transmitting informal information to a distant headquarters.1

Over time, improvements in information, communications, and financial technologies may partially mitigate the efficiency losses related to geographic expansion by making the physical distances between bank

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1. Geographical diversification can also increase financial institution risk. A bank's risk may increase if efficiency is reduced for any of the reasons described above or if the additional assets have low expected returns, low capital, and/or high variation of returns. In addition, the expanded institution may choose to take on more risk (e.g., by reducing loan

headquarters and local offices, and between banks and borrowers, less important. For example, credit scoring models and more cost-effective voice and Internet communications appear to have made it easier to analyze credit applications and monitor small business borrowers at greater distances. Consistent with this, one recent study found that the distances of small businesses from their banks has been increasing over time (Petersen and Rajan 2000). It seems reasonable that such advances might also make it easier to monitor loan officers and other bank personnel at greater distance.

However, we argue that physical distance matters, will continue to matter in the near future, and that technological advances can only partially mitigate the effects, both unfavorable and favorable, of distance on bank efficiency. For example, making relationship loans to borrowers that do not quality for credit scoring because of relatively weak financial statements and collateral of questionable value requires local knowledge that is difficult to quantify and transmit to a distant headquarters. This local knowledge includes not only financial information about the firm, but information about the firm's managers, its local economic environment, and its relationships with customers, suppliers, and local competitors. Because much of this information is difficult to quantify and transmit, so that verifying whether local loan performance problems are due to adverse local conditions, poor performance of the borrowers, or lax effort/incompetence of local loan officers becomes more difficult as distance increases. In addition, geographic expansion brings potential diversification benefits that increase with physical distance, as shown above. These benefits may accrue to banks that provide loans, deposits, or other financial products and services on a multiregional, national, or international basis. It is unlikely that advances in information, communications, and financial technologies will smooth out differences in regional economic conditions and fully mitigate these potential efficiency gains from geographic expansion.

3. Measuring bank efficiency

We first review the efficiency concepts employed and the methodology for estimating efficiency (section 3.1). We then describe the data and the efficiency estimates (section 3.2).

3.1 Efficiency concepts and methodology

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monitoring). Bank risk may also increase if return distributions are negatively skewed and the diversification increases the number of different events that can drive the bank into default (Winton 1999).

We estimate cost efficiency and profit efficiency, which measure how well a bank performs relative to a best-practice institution that produces the same output bundle under the same exogenous conditions. Cost efficiency is derived from a cost function of the form:

$$\ln C_{i,t} \ = \ f_t(w_{i,t}, y_{i,t}, z_{i,t}, v_{i,t}) \ + \ \ln u_i^C \ + \ \ln \varepsilon_{i,t}^C \ , \tag{1}$$

where C measures bank costs, including both operating and interest expenses; *i* indexes banks (*i*=1,N); *t* indexes time (*t*=1,T); f denotes some functional form; w is the vector of variable input prices faced by the bank; y is the vector of its variable output quantities; z indicates the quantities of any fixed netputs (inputs or outputs); v is a set of variables measuring the economic environment in the bank's local market(s); $\ln u^C$ is a factor that represents a bank's core efficiency; and $\ln \varepsilon^C$ is random error that incorporates both measurement error and luck.

We measure of cost efficiency for bank *i* by comparing its actual costs (adjusted for random error) to the minimum costs necessary to produce bank *i*'s output and other exogenous variables (w,y,z,v):

$$COSTEFF_i = \frac{\hat{C}_{\min}}{\hat{C}_i} = \frac{\exp[\hat{f}(w_i, y_i, z_i, v_i)] \times \exp[\ln \ \hat{u}_{\min}^C]}{\exp[\hat{f}(w_i, y_i, z_i, v_i)] \times \exp[\ln \ \hat{u}_i^C]} = \frac{\hat{u}_{\min}^C}{\hat{u}_i^C} \ , \tag{2}$$

where $\hat{u}_{\min}{}^C$ is the minimum $\hat{u}_i{}^C$ across all the banks in the sample. *COSTEFF* can be thought of as the proportion of costs or resources that are used efficiently. For example, a bank with *COSTEFF* = 0.70 is 70% efficient, or equivalently wastes 30% of its costs relative to a best practice bank facing the same conditions. These inefficiencies may reflect the inferior skills and knowledge of managers and/or the agency costs managers acting in their own interests, rather than those of the shareholders.

We measure profit efficiency based on a profit function with the same arguments as the cost function:

$$\ln(\pi_{i,t} + \theta_t) = f_t^{\pi}(w_{i,t}, y_{i,t}, z_{i,t}, v_{i,t}) + \ln u_i^{\pi} \ + \ \ln \varepsilon_{i,t}^{\pi} \ , \tag{3}$$

where π is bank profit; θ is a constant that makes $\pi+\theta$ positive for all banks (so that the log is defined); $\ln u^{\pi}$ represents the bank's core efficiency; and $\ln \varepsilon^{\pi}$ is a random error term. Using techniques similar to those for estimating cost efficiency, we construct a measure of profit efficiency for bank *i* by comparing its actual profits (adjusted for random error) to the maximum profits (i.e., the best practice) attainable given bank *i*'s outputs and other exogenous variables (w,y,z,v):

$$PROFEFF_i = \frac{\hat{\pi}_i}{\hat{\pi}_{\max}} = \frac{\left\{\exp[\hat{f}^{\pi}(w_i, y_i, z_i, v_i)] \times \exp[\ln \hat{u}_i^{\pi}]\right\} - \theta}{\left\{\exp[\hat{f}^{\pi}(w_i, y_i, z_i, v_i)] \times \exp[\ln \hat{u}_{\max}^{\pi}]\right\} - \theta} \;, \tag{4}$$

where $\hat{u}_{\max}{}^{\pi}$ is the maximum $\hat{u}_{\mathrm{i}}{}^{\pi}$ across all banks in the sample. *PROFEFF* can be thought of as the proportion of maximum profits that are earned. For example, a bank with *PROFEFF* = 0.70 is 70% efficient, or is forgoing about 30% of its potential profits through excessive costs, deficient revenues, or both. Again, these inefficiencies may reflect inferior managers, managers acting in their own interests, or both.

We use *PROFEFF* as our main measure of bank performance, because profit efficiency is conceptually superior to cost efficiency for evaluating overall firm performance. Profit efficiency is based on the economic goal of profit maximization, which requires that the same amount of managerial attention be paid to raising a marginal dollar of revenue as to reducing a marginal dollar of costs. *PROFEFF* may also better capture the benefits of cross-regional diversification of risk. As discussed, geographic diversification may increase the value of a bank's financial guarantees and its capacity to issue them, and may allow the bank to enhance its expected revenues by making higher risk-higher expected return investments. These benefits, as well as any expense reductions due to a lower cost of capital or a reduction in regulatory compliance costs, are generally included in *PROFEFF*. We also include *COSTEFF* primarily to diagnose whether differences in efficiency have their origins in cost control or in revenue generation.

PROFEFF is often called 'alternative' profit efficiency because the profit function in (3) specifies output quantities y, rather than output prices p as in a standard profit function. We use alternative profit efficiency rather than standard profit efficiency primarily because output prices are difficult to measure accurately for commercial banks, and because output quantities are relatively fixed in the short-run and cannot respond quickly to changing prices as is assumed in the standard profit function vary across banks more than output prices and thus better explain differences in bank profits. Prior research generally found similar results for estimates of standard and alternative profit efficiency. See Berger and Mester (1997) for an extended discussion of these issues.

We estimate both the cost function (1) and profit function (3) separately for each year in our 1993-1998 panel, allowing the estimated parameters to vary over time. We apply the distribution-free approach (Berger 1993) to the estimates to calculate *COSTEFF* and *PROFEFF*. For each bank, we calculate the six-year averages of the estimated residual terms ($\ln u^C + \ln\varepsilon^C$) and ($\ln u^\pi + \ln\varepsilon^\pi$). The core efficiency terms $\ln u$ are assumed to remain constant for each bank over time, and the random errors $\ln\varepsilon$ are assumed to tend to average out over time. To reduce the impact of substantial random outliers, we truncated the average residuals at the 5th and 95th percentiles of the distributions of their size classes. These truncated distributions of average residuals provide us with the variables $\ln\hat{u}_b{}^C$, $\ln\hat{u}_b{}^\pi$, $\ln\hat{u}_{min}{}^C$, and $\ln\hat{u}_{max}{}^\pi$ used in equations (3) and (5) to calculate a single set of cost and profit efficiency measures for each bank over the entire six-year period.2

We specify the cost and profit functions using the Fourier-flexible functional form. This hybrid functional form combines a conventional translog form with Fourier trigonometric terms. The resulting form is more flexible than the translog, and has been shown to fit the data for U.S. financial institutions better than the translog, especially when a relatively small number of extremely large or small banks are present in the data (McAllister and McManus 1993, Mitchell and Onvural 1996, Berger, Cummins, and Weiss 1997, Berger and DeYoung 1997, and Berger, Leusner, and Mingo 1997). The cost function includes three variable input prices (the local market prices of purchased funds, core deposits, and labor); four variable outputs *y* (consumer loans, business loans, real estate loans, securities); three fixed netputs *z* (off-balance-sheet activity, physical capital, financial equity capital); and an environmental variable *STNPL* (the ratio of total nonperforming loans to total loans in the bank's state) to control for the business conditions facing each bank.3 By using local market input prices, rather than the prices actually paid by each bank, our *COSTEFF* and *PROFEFF* estimates will reflect how well individual banks price their deposits and purchased funds. Specifying financial assets as outputs and

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2. The reasonableness of these assumptions depends on the length of period studied. If too short a period is chosen the random errors might not average out well, and if too long a period is chosen the bank's efficiency is less likely to remain constant. Using 1984-1994 data on U.S. commercial banks, DeYoung (1997) found that a six-year time period, such as we use here, reasonably balanced these concerns.

3. The variable input prices are average prices for the state or region in which the bank was located, and are constructed by dividing a bank's expenditures on the input in questions by the quantity purchased of that input, and then taking the asset-weighted average across the banks in that state or region. The variable loan outputs are measured gross of allowances for uncollectable loans. The variable securities output is measured as gross total assets less loans and physical capital; and the fixed off-balance sheet output is measured by the risk-weighted (based on the Basle Accord risk weights) amounts of items such as unused lines of credit, derivative contracts, etc.

financial liabilities and physical factors as inputs is consistent with the intermediation approach or the asset approach to modeling bank production (Sealey and Lindley, 1977).

The Fourier-flexible cost function is specified as follows:

$$
\begin{aligned}
\ln(C/w_3 z_3) = {} & \alpha + \sum_{i=1}^{2}\beta_i \ln(w_i/w_3) + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2}\beta_{ij}\ln(w_i/w_3)\ln(w_j/w_3) \\
& + \sum_{k=1}^{3}\gamma_k \ln(y_k/z_3) + \frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3}\gamma_{km}\ln(y_k/z_3)\ln(y_m/z_3) \\
& + \sum_{r=1}^{2}\delta_r \ln(z_r/z_3) + \frac{1}{2}\sum_{r=1}^{2}\sum_{s=1}^{2}\delta_{rs}\ln(z_r/z_3)\ln(z_s/z_3) \\
& + \frac{1}{2}\sum_{i=1}^{2}\sum_{k=1}^{3}\eta_{ik}\ln(w_i/w_3)\ln(y_k/z_3) \\
& + \frac{1}{2}\sum_{i=1}^{2}\sum_{r=1}^{2}\rho_{ir}\ln(w_i/w_3)\ln(z_r/z_3) \\
& + \frac{1}{2}\sum_{k=1}^{3}\sum_{r=1}^{2}\tau_{kr}\ln(y_k/z_3)\ln(z_r/z_3) \\
& + \sum_{n=1}^{7}[\phi_n\cos(x_n) + \omega_n\sin(x_n)] \\
& + \sum_{n=1}^{7}\sum_{q=n}^{7}[\phi_{nq}\cos(x_n + x_q) + \omega_{nq}\sin(x_n + x_q)] \\
& + \sum_{n=1}^{7}[\phi_{nnn}\cos(x_n + x_n + x_n) + \omega_{nnn}\sin(x_n + x_n + x_n)] \qquad (5) \\
& + \upsilon_1 \ln STNPL + \frac{1}{2}\upsilon_{11}[\ln STNPL]^2 + \ln u^{C} + \ln\varepsilon^{C}
\end{aligned}
$$

The profit function is identical to this cost function, except that the dependent variable becomes *ln* $[(\pi/w_3z_3)+\theta]$ and the composite error term is relabeled as $\ln u^{\pi} + \ln\varepsilon^{\pi}$. Costs, profits, and input prices are normalized by the price of labor (w_3) to impose linear input price homogeneity.4 Costs, profits, variable outputs, and fixed netputs are normalized by financial capital (z_3) to give the profit model more economic meaning, and to control for insolvency risk, heteroskedasticity, scale biases, and other estimation problems.5

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4. Thus, on the efficient frontier, a doubling of all input prices exactly doubles costs. Although not necessary, we impose this constraint on the alternative profit function as well.

5. Specifying financial equity capital as fixed helps resolve several estimation problems. First, high levels of financial capital reduce insolvency risk, which reduces costs *via* lower risk premia on substitutes for other perhaps more costly risk management activities. Second, financial capital provides an alternative to deposits as a funding source for loans, but it

Normalized in this way, the dependent variable in the profit functions is essentially the bank's return on equity, a measure of how well the bank is using its scarce financial capital. We add 1 to the arguments (y_k/z_3), (z_r/z_3), and *STNPL* in order to avoid taking the natural log of zero. The x_n terms, n=1,...,7 are re-scaled values of the *ln* (w_i/w_3), i=1,2; *ln* (y_k/z_3), k=1,2, 3; and *ln* (z_r/z_3), r=1,2 terms. To conserve degrees of freedom, we include only the 'own' third-order Fourier terms (e.g., $\cos(x_n + x_n + x_n)$), and exclude the third-order interactions (e.g., $\cos(x_n + x_m + x_q)$, m, q ≠ n).6 The standard symmetry restrictions apply to the translog portion of the function ($\beta_{ij} = \beta_{ji}$, $\gamma_{km} = \gamma_{mk}$, $\delta_{rs} = \delta_{sr}$). We exclude consideration of factor share equations embodying Shephard's Lemma or Hotelling's Lemma restrictions because these would impose the undesirable assumption of no allocative inefficiencies. We estimate the cost and profit equations using ordinary least squares.

3.2 Data and efficiency estimates

The data are annual observations for all U.S. commercial banks over 1993-1998, and were collected from the Reports of Condition and Income (call reports). There were 10,875 banks in the U.S. in 1993, which shrank to 8,713 as of 1998, primarily due to consolidation through M&As.7 We separated the data into two samples: a 'main sample' of institutions that had more than $100 million in gross total assets (1998 dollars) in all six years, and a 'small-bank sample' of institutions with less than $100 million in one or more years. Annual cost and profit functions were estimated for each sample of banks, using all observations with complete data in any given year. We calculated *COSTEFF* and *PROFEFF* for each of the 1,540 banks from the main

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has different cost characteristics than deposits: the initial cost of raising capital is high, but interest expense on capital is zero. Third, high levels of financial capital may indicate that managers are risk-averse (i.e., willing to accept lower risk in exchange for less than maximum profits and/or less than minimum costs), so including capital prevents us from labeling these banks as inefficient even though they are behaving optimally given their risk preferences. Fourth, failing to control for financial capital could yield a scale bias, because large banks tend to be better diversified than small banks, and as a result can manage their portfolio risk with lower levels of financial capital. We use an accounting measure of equity because market values are unavailable for most banks.

6. The Fourier-flexible form is a global approximation because the cos x_n, sin x_n, cos $2x_n$, sin $2x_n$, etc., terms are mutually orthogonal over the $[0,2\pi]$ interval (π refers here to radians, not profits), so that each additional term can make the approximating function closer to the true path of the data wherever it is most needed. The orthogonality is perfect only if the data are evenly distributed over the $[0,2\pi]$ interval, but in practice the Fourier terms have improved the fit of the data in every application of which we are aware. We cut 10% off each end of the $[0,2\pi]$ interval so that the x_n span $[0.1\times2\pi, 0.9\times2\pi]$ to reduce approximation problems near the endpoints. The formula for x_n is $0.2\pi - \mu\times a + \mu\times$variable, where [a,b] is the range of the variable being transformed, and $\mu \equiv (0.9\times2\pi - 0.1\times2\pi)/(b-a)$.

7. The direction of any survivor bias, and how it would affect our results, is not clear *a priori*. Many acquired banks retain their charters and continue to operate as affiliates of the acquiring organization; these banks remain in our data if the new owner of these banks was located in the same region as the old owner (which is most often the case).

sample and 6,331 banks from the small-bank sample that were present in all six annual regressions, were at least 50% owned by U.S. persons or by a U.S. BHC, and whose lead bank (if the bank was affiliated with a multibank BHC) was located in the same geographic region for all six years. We use these sampling criteria to help ensure that the lead bank-affiliate bank relationships in our data are stable across time. The means and standard deviations of the variables used in the cost and profit functions for these samples are shown in Table 2.

Although $100 million in assets is an arbitrary threshold, separating the very smallest banks from the rest of the population is important for several reasons. First, small banks generally attract relationship-based customers, as opposed to large banks, which tend to produce more transactions-driven services (Kwast, Starr-McCluer, and Wolken 1997). Second, these different business strategies may have implications the effects of organizational control and distance on efficiency. For example, managing and monitoring a small, relationship-based bank from afar may be more difficult than managing from the same distance a larger bank that sells more generic services. Third, the variation in costs and profits among the very smallest commercial banks is much greater than for the rest of the banking population (Berger and Humphrey 1991), suggesting that treating these banks separately may allow for more precise efficiency estimates for the main sample. We include both sets of banks in our analysis to be comprehensive – the small-bank sample comprises nearly 75% of industry banks, while the main bank sample contains nearly 90% of industry assets.

Our efficiency estimates are similar to those found in the literature. Average measured *COSTEFF* is 76.4% for the small banks and 78.0% for banks in the main sample. This suggests that the typical bank wastes about one-quarter of its expenses. Average measured *PROFEFF* is 66.3% and 66.8%, respectively, for the small-bank and main samples, suggesting that a typical bank forgoes about one-third of its potential profits.

4. Bivariate analysis

Our bivariate analysis consists of two comparisons. Section 4.1 compares the average efficiency of banks located in the same geographic region as their parent organization to the average efficiency of banks located in regions different than their parent. Section 4.2 compares the average efficiency of home-region banks in single-region organizations to the average efficiency of home-region banks in multiregional organizations. In both comparisons, we distinguish contiguous from noncontiguous regions, because a nationwide banking organization would require operations in home, contiguous, and noncontiguous regions.

4.1 Bivariate analysis: Same versus different region from the parent organization

Table 3 displays the mean values of *PROFEFF* and *COSTEFF* for various subsets of our small bank and main samples that isolate banks that are managed from within their home regions from banks that are managed cross-regionally.8 Row (a) shows the mean cost and profit efficiencies for banks located in the same geographic region as their parent organization's headquarters. Row (b) shows the mean efficiencies for banks located in one of the seven regions other than the one in which their parent organization is headquartered. Rows (c) and (d) disaggregate the row (b) data based on whether banks are located in regions that are contiguous or noncontiguous to their headquarters' region (definitions of contiguous regions are shown in the table notes).

Each cell in Table 3 contains, reading from top to bottom, the mean efficiency, number of banks, and standard error for the subset of banks in the cell. To test the effects of distant ownership, we compare the mean efficiencies of the banks in rows (b) through (d) to the mean efficiencies of the banks in row (a). The superscripts ** and * (superscripts ## and #) indicate that the average bank is statistically significantly *more* efficient (significantly *less* efficient) than the average bank in row (a) at the 5 and 10 percent levels, two-sided.

The data for the main sample indicate that banks located in different geographic regions than their parents tend to be somewhat more efficient than average. Comparing rows (a) and (b) for the main sample, banks located outside their headquarters' regions are more efficient than banks located within their headquarters' regions, by an average of 2.7% of costs (80.5% versus 77.8%). A larger difference is revealed when we differentiate between contiguous and noncontiguous regions. In row (c), banks in regions contiguous to their headquarters have 4.8% better cost efficiency than within-region banks on average (82.0% versus 77.8%), while in row (d) this difference disappears for banks located in noncontiguous regions. Although the differences in rows (b) and (c) are statistically significant, they are economically small compared to the overall variation in cost efficiency. The standard deviation of *COSTEFF* is 8.75% and the inter-quartile spread in *COSTEFF* (25^{th} to 75^{th} percentiles) is 11.3% for all banks in the main sample. Hence, these differences do not

8. We include banks not affiliated with holding companies and banks in one-bank holding companies as being in the same region as the parent organization (i.e., they are their own parents).

by themselves provide a strong motivation for cross-regional or nationwide expansion. Furthermore, the main sample data show no statistically significant differences between the profit efficiency of within-region and cross-regionally owned banks.

The results are similar for the small-bank sample. Small banks located outside their headquarters region are statistically more efficient than within-region banks by an average 4.7% of costs (81.0% versus 76.3%); the average efficiency difference increases to 5.4% of costs and 3.2% of potential profits for small banks located in contiguous regions; and the efficiency differences disappear for small banks located at noncontiguous distances. However, these differences are small relative to the standard deviation of 8.73% and inter-quartile range of 11.4% for small bank *COSTEFF*, and even smaller relative to the standard deviation of 14.49% and inter-quartile range of 18.96% for small-bank *PROFEFF*.

These results have several implications. First, they suggest that cost-efficient organizations may be able to spread their superior skills and procedures to banks in nearby states and regions. Second, they imply the existence of organizational diseconomies to operating or monitoring an institution from afar that offset these cost efficiencies as banks move further away from their organizational headquarters. Finally, the weaker profit efficiency results imply that superior cost efficiency may be roughly offset by revenue shortfalls in cross-regionally owned banks, perhaps indicating that it is more difficult to manage revenue generation from a distance than to manage bank costs from a distance. This is most evident in the small bank data, where profit efficiency declines by 9.1% between the contiguous and noncontiguous subsamples. It may be the case that organizational diseconomies to operating or monitoring an institution from afar make it especially difficult to provide relationship-based products (e.g., small business loans) in which small banks typically specialize

4.2 Bivariate analysis: Single-region versus multiregional parent organizations

It seems unlikely that a superregional or nationwide banking organization would be successful without being efficient in its home markets. We evaluate this proposition using the data displayed in Table 4, which compares the efficiencies of banks from single-region organizations to the efficiencies of banks from cross-regional organizations. Row (a) displays the mean cost and profit efficiencies for banks whose parent organizations do not own any banks outside of that geographic region. Row (b) displays the mean cost and profit efficiencies for home-region banks that are owned by cross-regional banking organizations. Rows (c) and (d) disaggregate the row (b) results based on the contiguous or noncontiguous geographic scope of the parent organizations.9

There are two additional reasons for evaluating the efficiency of the home-region banks. First, the benefits and costs associated with cross-regional diversification can accrue throughout the organization, not just in the out-of-region affiliate banks. Bank holding companies may serve as internal capital markets to reallocate funds where they are most productive (Houston, James, and Marcus 1997, Houston and James 1998, Klein and Saidenberg 2000). In addition, senior management's attention may become focused on improving the efficiency of recently purchased banks in other regions, and unintentionally let the efficiency of the home-region banks deteriorate. Second, the results in Table 4 act as a control for accounting anomalies caused by inaccurate transfer pricing. For example, if the lead bank in the organization provides services for the affiliate banks (e.g., data or payments processing, advertising and marketing, human resources support, etc.) but does not fully price those services, then the superior cost efficiencies that we find for cross-regionally owned banks in Table 3 could simply be a reflection of those subsidies. However, if we find that banks owned by multiregional organizations perform better than average regardless of their location, then it is unlikely that inaccurate transfer pricing is a problem.

The results in Table 4 show that on average, home-region banks from multiregional organizations (row (b)) are both more cost efficient and more profit efficient than banks from single-region organizations (row (a)). In our main sample, the row (b) banks have statistically significant efficiency advantages equal to 3.5% of costs and 2.1% of potential profits, and in our small-bank sample, the row (b) banks have statistically significant efficiency advantages equal to 6.2% of costs and 3.5% of potential profits. Moreover, the average difference in cost efficiency widens as the geographic scope of the organization increases. Cost efficiency improves 2.0% and 2.6% of costs, respectively, in the main bank and small-bank samples as the organization expands into noncontiguous regions (from row (c) to row (d)). However, much like our Table 3 analysis, the cost efficiency differences are relatively small, and the profit efficiency differences disappear entirely as organizations expand into noncontiguous regions. The latter result implies that problems managing organization-wide revenues eventually occur as the geographic scope of the organization expands.

9. The number of observations in rows (a) and (b) of Table 4 equal the number of observations in row (a) of Table 3.

It is difficult to draw strong conclusions from the bivariate analysis shown in Tables 3 and 4 because the results mix the efficiency effects of control and distance with an organization's choice of geographic strategy. For example, organizations that choose to expand geographically may also be the organizations that are best at controlling affiliates at a distance. We attempt to separate out these effects in the regression analysis that follows.

5. Regression analysis

We test the effects of organizational control and distance on affiliate efficiency using the following multiple regression framework:

$$\begin{aligned} NONLEADEFF = {} & \alpha + \beta_1 * LEADEFF + \beta_2 * \ln DISTANCE + \beta_3 * LEADEFF * \ln DISTANCE \\ & + \beta_4 * SAMESTATE + \beta_5 * MSA + \beta_6 * HERF + \beta_7 * \ln BKASS + \beta_8 * \tfrac{1}{2}(\ln BKASS)^2 \\ & + \beta_9 * \ln HCASS + \beta_{10} * \tfrac{1}{2}(\ln HCASS)^2 + \beta_{11} * BKMERGE + \beta_{12} * HCMERGE \\ & + \beta_{13} * REGION + \beta_{14} * UNMAPPEDNL + \beta_{15} * UNMAPPEDL + \nu. \end{aligned} \tag{6}$$

We estimate (6) separately for cost and profit efficiency and for the main sample and the small-bank sample using OLS techniques. NONLEADEFF is the efficiency (cost or profit) of a non-lead bank affiliate. LEADEFF is the same type of efficiency (cost or profit) of the lead bank, defined as the largest banking affiliate in the BHC. We maintain that LEADEFF is a good proxy for the skills, policies, and practices available to manage the entire organization. lnDISTANCE is the natural log of the distance in miles between the affiliate bank and its lead bank (one mile added before logging). SAMESTATE is a dummy equal to one if the affiliate is located in the same state as the lead bank. MSA is a dummy equal to one if the affiliate is located in a metropolitan statistical area. HERF is the affiliate's average Herfindahl index, weighted by the share of its deposits that come from each MSA or non-MSA county. BKASS equals the gross total assets of the affiliate bank, and HCASS equals the sum of BKASS over all of the bank affiliates in the BHC. BKMERGE is a dummy equal to one if the affiliate was the surviving bank in a merger during 1990-1997 in which two or more bank charters were consolidated, and HCMERGE is a dummy equal to one if the affiliate was acquired by a BHC during 1990-1997 but retained its bank charter. REGION is a vector of dummies that indicate the BEA region in which the affiliate is located. Summary statistics are displayed in Table 5.

We used mapping software to compute the distance "as the crow flies" between the cities in which the affiliate banks and lead banks were located. Although one could contemplate using alternative measures of distance between two cities (e.g., actual distance traveled, or total travel time), such measures are not easily at our disposal, and in any event these alternative measures are likely highly correlated with lnDISTANCE. The maximum distance was 3,303 miles from Anchorage to Houston and the minimum distance was zero. The lead and non-lead affiliates in our sample were located in 1,912 different U.S. cities, and we were able to match 1,150 of those cities to an exact geographic location. We assigned banks in the other 762 unmappable cities to the city that is the state's banking center, which in most cases is the largest city in the state.10 To partially control for the measurement distortion that this introduces, we add the dummies UNMAPPEDNL and UNMAPPEDL to equation (6), which equal one when the non-lead bank and the lead bank, respectively, were located in an unmappable city. The degree of measurement distortion should diminish as the non-lead bank moves further from the state of its lead bank.

The derivative ∂NONLEADEFF/∂LEADEFF = $\beta_1+\beta_3$*lnDISTANCE measures the association between lead bank efficiency and non-lead bank efficiency, given the distance between the two banks and holding constant the values of the other regressors. As such, this derivative may reflect the degree to which the organization is able to control the operations of its affiliate banks through the transfer of its management skills, policies, and practices. We expect this derivative to be positive if organizations exercise some control over their affiliates, but less than 1; a value of 1 would indicate that a given increase in lead bank efficiency would be fully matched by an equal increase in non-lead efficiency. A positive derivative that declines with distance, i.e., with $\beta_3<0$, would be consistent with longer distances interfering with the control of organization over its affiliates' efficiency.

The derivative ∂NONLEADEFF/∂lnDISTANCE = $\beta_2+\beta_3$*LEADEFF reflects the degree to which affiliate bank efficiency increases or declines with its distance from the lead bank, given the efficiency of the lead bank and holding constant the values of the other regressors. We have no *a priori* expectation regarding the sign of this derivative. A negative sign would be consistent with the hypothesis that geographically dispersed banking firms experience organizational diseconomies that make it difficult to manage and monitor

10. We used the largest city in the state, except for in California (San Francisco instead of Los Angeles), Missouri (St. Louis instead of Kansas City), and Virginia (Richmond instead of Virginia Beach).

affiliates from afar. A positive sign would be consistent with the hypothesis that efficiently managed organizations can overcome any such organizational diseconomies, perhaps in part through the benefits of geographic diversification.

We acknowledge that mismeasurement of LEADEFF (which we measure with estimation error) and lnDISTANCE (which we measure with error for unmappable banks) could introduce bias into the estimated regression coefficients. The coefficients on LEADEFF, lnDISTANCE, and LEADEFF*lnDISTANCE may each be biased toward zero, making it difficult to reject the null hypothesis associated with these coefficients.11 Other biases may be present as well. The relationship between LEADEFF and NONLEADEFF, measured by the estimated sum $\beta_1+\beta_3$*lnDISTANCE could be biased downward if there are cross-subsidies (in either direction) between the lead bank and the non-lead affiliate through inaccurate transfer pricing or other intra-organizational accounting methods.12 Conversely, this estimated sum could be biased upward if the lead bank and its non-lead banks are exposed to common economic shocks not controlled for elsewhere in our estimations.13 However, our results below suggest it is unlikely that these biases materially affect the conclusions that we draw from our analysis.

The coefficients on SAMESTATE may be positive, reflecting the benefits of operating under a single set of state regulations, or negative because of poor risk diversification. The coefficients on HERF may be positive in the profit efficiency equations and negative in the cost efficiency regressions — consistent with the literature (Berger and Mester 1997, Berger and Hannan 1998) — as banks with more market power may raise prices and profits, but may have higher costs due to reduced competitive pressures to keep costs under control. The coefficients on MSA may take any sign because of the many differences between metropolitan and rural

11. We cannot correct for this bias because we know neither the variance of the measurement errors nor their covariances with the true values of the variables in question.

12. Table 5 contains circumstantial evidence of subsidies that flow from lead banks to non-lead banks – lead banks (LEADEFF) are on average less cost and profit efficient than non-lead banks (NONLEADEFF) in both the main sample and the small-bank sample. To some extent, these averages simply reflect the fact that banking organizations with large numbers of affiliates tend to exhibit above-average affiliate efficiency. For example, for organizations with 10 or more affiliates, mean affiliate cost efficiency was above the sample mean at 24 of 33 organizations, and mean affiliate profit efficiency was above the sample mean in 20 of the 33 cases.

13. NONLEADEFF and LEADEFF are constructed from the residuals from the same cost and profit functions. If a non-lead affiliate and its lead bank experienced a common shock (e.g., a change in economic conditions or a regulatory action common to the location of both banks) not controlled for in the functions, then the effects of that shock will be captured in those residuals, and hence will be commonly embedded in the efficiency measures NONLEADEFF and LEADEFF.

markets. We expect the coefficients on lnBKASS and ½lnBKASS^2 to reveal a positive relationship between efficiency and bank size, based on earlier studies that found the smallest banks to be the least efficient (e.g., Berger and Humphrey 1991). We include lnHCASS and ½lnHCASS^2 to capture the efficiency effects of agency costs, internal capital markets, and other factors that may vary with BHC size, and to prevent the efficiency effects of our key variable lnDISTANCE from being confounded with the efficiency effects of BHC size, which may be strongly related to lnDISTANCE. The coefficients on the BKMERGE and HCMERGE variables could be either positive or negative, depending upon the dynamic effects of consolidation on bank efficiency. We also have no *a priori* expectations for the signs on the REGION coefficients, nor for the signs on UNMAPPEDNL and UNMAPPEDL.

5.1 Regression results

Table 6 displays the results of equation (6) for cost and profit efficiency for both the main sample and small-bank sample. These estimates suggest that on average the efficiency of a non-lead affiliate bank is strongly influenced by the efficiency of its lead bank, but not by the distance to its lead bank. The coefficient β_1 on LEADEFF is positive and highly significant in all four regressions; the coefficient β_2 on lnDISTANCE is positive but generally insignificant; and the coefficients β_3 on the LEADEFF*lnDISTANCE interaction terms are negative and generally insignificant. The derivative ∂NONLEADEFF/∂LEADEFF = $\beta_1+\beta_3$*lnDISTANCE is positive and significantly different from zero at the sample means in all four regressions, consistent with lead banks exercising some control over the operations of their affiliate banks through transfers of management skills, policies, and practices. In contrast, the derivative ∂NONLEADEFF/∂lnDISTANCE = $\beta_2+\beta_3$*LEADEFF is not statistically different from zero when evaluated at the sample means in any of the four regressions.

To see how the control of the parent organization varies with distance, Table 7 shows how the estimated value of ∂NONLEADEFF/∂LEADEFF declines as non-lead banks are increasingly distant from their lead banks. For example, the first column of Table 7 shows that this derivative equals 0.3182 for affiliate banks located at 0 miles from their lead banks. That is, a one percentage point increase in lead bank cost efficiency is associated with a 0.3182 percentage point increase in non-lead cost bank efficiency. However, this derivative is only half as large(0.1688) at a distance of 288 miles, the average distance for a main sample affiliate located outside its lead bank's home state but within its home region, and this derivative becomes statistically insignificant at the maximum distance in the main sample. Figure 1 displays this information graphically, plotting each of the four derivatives from Table 7 continuously against the distance between the non-lead affiliate and its lead bank. The figure suggests that organizational control over affiliate bank cost efficiency dissipates more with distance than does organizational control over affiliate bank profit efficiency (each cost efficiency derivative curve quickly falls below the profit efficiency derivative curve for the same sample). This may indicate that revenue gains from geographic diversification offset a large portion of the organizational cost diseconomies that come with geographic dispersion. The figure also suggests organizational control over small bank efficiency dissipates more with distance than does organizational control over the efficiency of larger affiliate banks (each small-bank sample curve quickly falls below the main sample curve for the same efficiency concept). This may indicate that organizations experience relatively greater difficulties monitoring and managing from a distance relationship-based activities and other locally-based financial services in which most small banks specialize.

Our finding of a strong positive relationship between lead bank efficiency and non-lead bank efficiency may reflect factors other than organizational control. As noted above, cross-subsidies in either direction between the lead and non-lead banks would tend to give a downward bias to the measured derivative ∂NONLEADEFF/∂LEADEFF, and so our finding of a strong positive effect suggests that such a bias is not dominant. We also noted that there could be an upward bias due to common shocks that affect the measured efficiency of the lead and non-lead banks similarly. To test for the possibility that common shocks are the cause of the positive estimated relationship between NONLEADEFF and LEADEFF, we re-estimated (6) after adding the interaction variable LEADEFF*SAMESTATE to the right-hand-side of the equation (results shown only in Berger and DeYoung 2000). Common economic shocks are most likely to occur if the lead and non-lead bank are in the same state, so if common shocks are driving our result, then this interaction variable should have a positive coefficient and soak up much of the positive relationship between lead bank and non-lead bank efficiency. However, none of these 4 regressions produced a significant positive coefficient on this variable, and in most cases the other regression coefficients were materially unaffected. In the small bank cost and profit efficiency regressions, the signs, significance levels, and relative magnitudes of the coefficients β_1, β_2, and β_3 were unchanged. In the main sample cost regression, the derivative with respect to LEADEFF remained positive and significant, but it was statistically significant only for same-state affiliate banks – a result that, if considered in isolation, is consistent with the presence of common local shocks. But we found no evidence of common shocks in the more comprehensive main sample profit regressions – the coefficient on LEADEFF*SAMESTATE was significant but negative, and the overall derivative with respect to LEADEFF was similar to the Table 6 result in terms of sign, magnitude, and significance level. Thus, it is unlikely that common economic shocks are driving our main result.

The coefficients on SAMESTATE, HERF, BKASS, HCASS, and BKMERGE are statistically significant in at least two of the four Table 7 regressions, with signs that are generally consistent with our expectations. The coefficients on the REGION dummies suggest the non-lead affiliates in the Plains, Southeast, Southwest, and Rocky Mountains regions tend to be more profit efficient than those in other regions, suggesting favorable economic or regulatory conditions in these regions over this time period. The coefficients on MSA, HCMERGE, UNMAPPEDNL, and UNMAPPEDL are statistically significant in only one regression or not at all, and do not have consistent signs across the regressions.

In Table 8 we use a slightly different procedure for separating the effects of organizational control and distance. We exclude the interaction variable LEADEFF*lnDISTANCE from equation (6), and then estimate the model for subsamples of affiliate banks located at various distances from their lead banks. In panel (a) we estimate the model for the full sample of non-lead affiliate banks of multibank BHCs, and panels (b), (c), and (d) display estimation results for subsamples of affiliates located in different states from their lead banks, in different regions from their lead banks, and in regions noncontiguous to their lead banks, respectively.

The results in Table 8 suggest that organizational control, geographic distance, and the characteristics of individual organizations may **all** be important determinants of affiliate bank efficiency. First, the coefficient on LEADEFF is always positive, and is statistically significant in 9 of the 16 regressions, reinforcing the earlier results that affiliate bank efficiency is strongly correlated with lead bank efficiency. Second, the coefficients generally (but not always) increase in size as the affiliate bank subsamples move further away from the lead bank. For example, in the second column of Table 8 the coefficient on LEADEFF increases from 0.2774 to 0.3898 to 0.5008 to 0.9141 as geographic dispersion increases. This suggests that organizations that choose to be geographically dispersed tend to be organizations that are relatively capable at controlling their affiliates.

Third, although the coefficient on lnDISTANCE is statistically significant in only 4 of the 16 regressions, all four of these coefficients are negative and occur in the out-of-state and out-of-region subsamples where distance is likely to be measured accurately and is likely to matter most.14 This is weak evidence of a pure distance effect in which increased distance from the lead bank reduces affiliate bank efficiency.

6. Individual organization analysis

In contrast to the previous analyses in which we focused on the average effects of control and distance on bank efficiency, we now disaggregate the data and focus instead on the efficiency of affiliates within individual multibank organizations. We attempt to identify whether certain geographic strategies (e.g., statewide, regional, or superregional banking) are more often associated with efficient organizations than other geographic strategies. We also attempt to identify whether many, some, or none of the multibank organizations in our data are good candidates to sustain nationwide banking organizations in the future. We note that the Riegle-Neal Act currently limits to 10% the total share of nationwide bank and thrift deposits that any organization may obtain via M&As, which makes it difficult for any institution to operate a full service banking operation on a nationwide basis.

To make this analysis tractable, we limit our investigation to the 33 organizations in our data with 10 or more affiliate banks (including the lead bank). Table 9.1 displays cost efficiency data for these organizations, and Table 9.2 displays profit efficiency data for these organizations.15 Data for each of the 33 organizations is displayed on a separate row. In column (1), we categorize the geographic scope of each organization as either "statewide," "regional," "superregional contiguous," or "superregional noncontiguous." "Statewide" organizations only own affiliates in their home states. "Regional" organizations own affiliates outside their home states, but not beyond their home regions. "Superregional contiguous" organizations own affiliates outside their home regions, but only in regions that are contiguous to their home regions. "Superregional noncontiguous" organizations own affiliates in regions that are not contiguous to their home

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14. Panel (d) contains noncontiguous affiliates for which an additional mile of distance is less meaningful. Panel (a) contains same-state affiliates for which the distance mapping problems are most likely to cause distortions.
15. To simplify the analysis, Tables 9.1 and 9.2 do not report separate results for banks in the main sample and small bank sample. This should have little effect on our analysis because, as we report in section 3.1 above, the distributions of *COSTEFF* and *PROFEFF* were very similar for the two samples.

regions. We distinguish between “superregional contiguous” organizations and “superregional noncontiguous” organizations, because the latter have a geographic scope that is closer to nationwide banking and we wish to see whether nationwide banking might be an efficient geographic strategy. While these 33 organizations represent just a small fraction of the 733 multibank organizations in the data, they include multibank holding companies with a variety of different geographic strategies; as such, analyzing the efficiency of these organizations may provide a good indication of whether managers can efficiently operate large numbers of affiliates on a statewide, regional, superregional or nationwide basis.16

Column (2) shows the number of affiliate banks in each of these organizations. The remainder of the columns in Tables 9.1 and 9.2 contain information about the cost and profit efficiency of each organization’s affiliate banks. Organizations are listed from most cost or profit efficient to least efficient, based on the (unweighted) mean efficiencies of their affiliate banks in column (3). The ordering in Table 9.1 is based on cost efficiency rank, and the ordering in Table 9.2 is based on profit efficiency rank. Columns (4) through (7) display the mean efficiencies of affiliate banks that are located at various geographic distances from the lead bank. The superscript "A" identifies cells in which the reported efficiency mean is higher than mean efficiency of the affiliates in all 733 multibank organizations in the data. The superscript "B" shown in column (1) identifies organizations whose affiliates have above-average efficiency in each of the geographic locations in which the organization operates (i.e., rows in which the superscript “A” appears in every populated cell in columns (4) through (7)).

There are three main results in Tables 9.1 and 9.2. First, organizations with 10 or more affiliates tend to be more efficient than multibank organizations with smaller numbers of affiliates. Of the 33 organizations shown in these tables, 24 had mean cost efficiencies higher than the 0.7989 average for all affiliates of multibank organizations (column (3) in Table 9.1), and 20 had mean profit efficiencies higher than the 0.6931 average for all affiliates of multibank organizations (column (3) in Table 9.2). Second, there is evidence that some already widely dispersed organizations may be good candidates to sustain nationwide banking organizations in the future. For example, 4 of the 6 superregional noncontiguous organizations in Table 9.2

16. These 33 organizations with 10 or more affiliates account for 5 of the 549 statewide multibank organizations, 4 of the 73 regional multibank organizations, 18 of the 76 superregional contiguous multibank organizations, and 6 of the 35

operated affiliates with above-average profit efficiency in noncontiguous regions, and for the most part also operated efficiently in the areas closer to the organizations' headquarters. Third, among the "geographically efficient" organizations that carry the "B" superscript in the tables, no single geographic scope is dominant. Again using profit efficiency as our benchmark, 2 statewide organizations were geographically efficient; 3 regional organizations were geographically efficient; 3 superregional contiguous organizations were geographically efficient; and 2 superregional noncontiguous organizations were geographically efficient. Consistent with the results in the prior analyses, this suggests that well-managed organizations can spread their efficient management skills/policies/procedures across affiliate banks regardless of the geographic spread of the organization.

7. Conclusions

We estimate the cost and profit efficiency of over 7,000 U.S. commercial banks between 1993 and 1998 and use those estimates to assess the impact of geographic expansion on bank efficiency. We find both positive and negative links between geographic scope and bank efficiency. For example, while banks in organizations that expand into nearby states and regions tend to have higher levels of efficiency, organizational control over affiliate bank efficiency tends to diminish as affiliates move further away from the parent, especially for small bank affiliates with less than $100 million in assets. But these distance-related efficiency effects tend to be modest in size, and our results suggest that efficient parent organizations can export their superior skills, policies, and practices to their affiliates and overcome any negative effects of distance. These results imply that operating an efficient banking organization may not necessarily conform to any one particular geographic strategy. An individual organization analysis of a number of large multibank BHCs with varying geographic structures confirms this notion.

These results may have important implications for the future structure of the banking industry. First, the data suggest that domestic banking organizations that operate statewide, across state lines, across geographic regions, or nationwide are likely to coexist in the future without any one type of organization having a sufficient efficiency advantage to drive the others out of existence. Such a result would be consistent with projections made elsewhere that several thousand banking organizations are likely to disappear during the

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superregional noncontiguous multibank organizations in the data.

adjustment to deregulation, but that the remaining banks will still number in the thousands (e.g., Berger, Kashyap, and Scalise 1995). Our results also suggest that very small banks may be less likely to be efficiently owned and operated by nationwide organizations, perhaps due to organizational diseconomies to operating or monitoring from afar an institution that specializes in relationship-based lending or locally-oriented services.

The results may also have some bearing on the debate over why most studies of cross-border bank efficiency found that foreign affiliates are on average less efficient than the domestic banks in the same nation. To the extent that our findings may extrapolate to cross-border applications, the data suggest that distance-related inefficiencies are unlikely to explain the cross-border findings. If domestic banks can operate efficiently at any distance from their parent organizations within a large nation like the U.S., then it is unlikely that distance-related inefficiencies are responsible for the finding that domestic banks are usually more efficient than foreign banks. The cross-border findings may be more likely associated with other potential international barriers to efficiency – such as differences in language, culture, currency, and regulatory/supervisory structures.

Some additional important caveats apply to our findings. First, during our 1993-1998 sample period, most interstate banking was done via BHC affiliation, and our efficiency findings for these affiliate banks may not apply to future networks of bank branches. More efficient nationwide geographic scope may be more likely in the future, since geographically expansive banking organizations will be able to choose whichever organizational form is most efficient for them. Second, substantial restrictions on interstate acquisitions were in place prior to, as well as during the first part, of our sample period. Future efficiencies from cross-border expansion may be higher than found here if the past restrictions mainly prevented efficient organizations from expanding. Third, we do not observe any truly nationwide banking organizations in our data (i.e., organizations with conventional deposit-taking offices in all 50 states), and such organizations may be deterred in the U.S., given that the Riegle-Neal Act limits the national share of bank and thrift deposits that any single organization may obtain by consolidation to 10%. Therefore, our evaluation of nationwide banking is based on extrapolating the existing pattern of cross-regional ownership to a geographical spread that does not presently exist and may not occur in the future. Fourth, technological change may reduce distance-related efficiency barriers, enabling organizations to more efficiently process information, market their services, manage across geographic distance, and manage the risks of institutions with greater geographic scope in the future. Finally, we urge great caution in extrapolating these results to other nations or to cross-border applications, given that distance effects could be compounded with many other differences between the U.S. and other markets.

References

Akhavein, J.D., A.N. Berger, and D.B. Humphrey. 1997. “The Effects of Bank Megamergers on Efficiency and Prices: Evidence from the Profit Function.” *Review of Industrial Organization* 12: 95-139.

Al-Faraj, T.N., A.S. Alidi, K.A. Bu-Bshait. 1993. “Evaluation of Bank Branches by Means of Data Envelopment Analysis”, *International Journal of Operations and Production Management* 13: 45-52.

Athanassopoulos, A.D. 1997. “Service Quality and Operating Efficiency Synergies for Management Control in the Provision of Financial Services: Evidence from Greek Bank Branches,” *European Journal of Operational Research* 98: 300-313.

Athanassopoulos, A.D. 1988. “Service Quality and Operating Efficiency Synergies for Management Control in the Provision of Financial Services,” *Journal of Money, Credit, and Banking* 30: 172-92.

Berger, A.N. 1993. “’Distribution-Free’ Estimates of Efficiency in the U.S. Banking Industry and Tests of the Standard Distributional Assumptions.” *Journal of Productivity Analysis* 4(3): 261-292.

Berger, A.N. 1998. “The Efficiency Effects of Bank Mergers and Acquisition: A Preliminary Look at the 1990s Data.” In *Bank Mergers & Acquisitions*, edited by Y. Amihud and G. Miller. Boston, MA. Kluwer Academic: 79-111.

Berger, A.N., J.D. Cummins, M.A. Weiss. 1997. “The Coexistence of Multiple Distribution Systems for Financial Services: The Case of Property-Liability Insurance.” *Journal of Business* 70(4): 515-546.

Berger, A.N., and R. DeYoung. 1997. “Problem Loans and Cost Efficiency in Commercial Banks,” *Journal of Banking and Finance* 21: 849-870.

Berger, A.N., R. DeYoung, H. Genay, and G.F. Udell. 2000. “Globalization of Financial Institutions: Evidence from Cross-Border Banking Performance.” *Brookings-Wharton Papers on Financial Services* 3: 23-158.

Berger, A.N., and T.H. Hannan. 1998. “The Efficiency Cost of Market Power in the Banking Industry: A Test of the “Quiet Life” and Related Hypotheses.” *Review of Economics and Statistics* 80(3): 454-465.

Berger, A.N. and D.B. Humphrey. 1991. “The Dominance of Inefficiencies over Scale and Product Mix Economies in Banking.” *Journal of Monetary Economics* 28(1): 117-148.

Berger, A.N. and D.B. Humphrey. 1992. “Megamergers in Banking and the Use of Cost Efficiency as an Antitrust Defense.” *Antitrust Bulletin*, 37 (Fall), 541-600.

Berger, A.N. and D.B. Humphrey. 1997. “Efficiency of Financial Institutions: International Survey and Directions for Future Research.” *European Journal of Operational Research* 98: 175-212.

Berger, A.N., A.K. Kashyap, and J.M. Scalise. 1995. “The Transformation of the U.S. Banking Industry: What a Long, Strange Trip It's Been.” *Brookings Papers on Economic Activity* 2: 55-201.

Berger, A.N., J.H. Leusner, and J.J. Mingo. 1997. “The Efficiency of Bank Branches.” *Journal of Monetary Economics* 40(1): 141-162.

Berger, A.N. and L.J. Mester. 1997. "Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions?" *Journal of Banking and Finance* 21: 895-947.

Bhattacharya, A., C.A.K. Lovell, and P. Sahay. 1997. "The Impact of Liberalization on the Productive Efficiency of Indian Commercial Banks." *European Journal of Operational Research* 98: 332-345.

Chang, C.E., I. Hasan, and W.C. Hunter. 1998. "Efficiency of Multinational Banks: An Empirical Investigation," *Applied Financial Economics* 8(6): 1-8.

Demsetz, R.S. and P.E. Strahan. 1997. "Diversification, Size, and Risk at Bank Holding Companies." *Journal of Money, Credit, and Banking* 29(3): 300-13.

DeYoung, R. 1997. "A Diagnostic Test for the Distribution-Free Efficiency Estimator: An Example Using U.S. Commercial Bank Data." *European Journal of Operational Research* 98: 243-249.

DeYoung, R. and D.E. Nolle. 1996. "Foreign-Owned Banks in the U.S.: Earning Market Share or Buying It?" *Journal of Money, Credit, and Banking* 28(4): 622-636.

Drake, L., and B. Howcroft. 1995. "Measuring the Relative Efficiency of the Selling Function: An Application of Data Envelopment Analysis to UK Bank Branches", working paper, Loughborough University, U.K.

Giokas, D. 1991. "Bank Branch Operating Efficiency: A Comparative Application of DEA and the Loglinear Model," OMEGA International Journal of Management Science 19: 549-47.

Grabowski, R., N. Rangan, and R. Rezvanian. 1993. "Organizational Forms in Banking: An Empirical Investigation of Cost Efficiency." *Journal of Banking and Finance* 17: 531-538.

Hasan, I. and W.C. Hunter. 1996. "Efficiency of Japanese Multinational Banks in the United States," *Research in Finance* 14: 157-173.

Hasan, I. and A. Lozano-Vivas. 1998. "Foreign Banks, Production Technology, and Efficiency: Spanish Experience." Working Paper presented at the Georgia Productivity Workshop III. Athens, Georgia.

Hughes, J.P., W. Lang, and L.J. Mester, and C.-G. Moon. 1996. "Efficient Banking Under Interstate Branching." *Journal of Money, Credit, and Banking* 28(4): 1043-1071.

Hughes, J.P., W. Lang, L.J. Mester, and C.-G. Moon. 1999. "The Dollars and Sense of Bank Consolidation." *Journal of Banking and Finance* 23(2-4): 291-324.

Klein, P.G. and M.R. Saidenberg. 2000. "Organizational Structure and the Diversification Discount: Evidence from Commercial Banking," Federal Reserve Bank of New York working paper.

Kwast, M.L., M. Starr-McCluer, and J.D. Wolken. 1997. "Market Definition and the Analysis of Antitrust in Banking." *Antitrust Bulletin* 42(4): 973-995.

Mahajan, A., N. Rangan, and A. Zardkoohi. 1996. "Cost Structures in Multinational and Domestic Banking." *Journal of Banking and Finance* 20(2): 238-306.

McAllister, P.H. and D.A. McManus. 1993. "Resolving the Scale Efficiency Puzzle in Banking." *Journal of Banking and Finance* 17(2-3): 389-405.

Mester, L.J. 1996. A study of bank efficiency taking into account risk-preferences, *Journal of Banking and Finance* 20, 1025-1045.

Miller, S.R. and A. Parkhe. 1999. "Home-Country Environment as a Source of International Competitiveness: An Analysis of the Global Banking Industry." Michigan State University.

Mitchell, K. and N. M. Onvural. 1996. "Economies of Scale and Scope at Large Commercial Banks: Evidence from the Fourier Flexible Functional Form." *Journal of Money, Credit, and Banking* 28(2): 178-99.

Oral, M., and Yolalan, R.. 1990. "An Empirical Study on Measuring Operating Efficiency and Profitability of Bank Branches," European Journal of Operational Research 46: 282-94.

Parkan, C. 1987. "Measuring the Efficiency of Service Operations: An Application to Bank Branches", *Engineering Costs and Production Economics*, 12: 237-42.

Parkhe, A. and S.R. Miller. 1999. "Is There a Liability of Foreignness in Global Banking? An Empirical Test of U.S. Banks' X-Efficiency." Michigan State University.

Pastor, J.T. 1993. "Efficiency of Bank Branches Through DEA: The Attracting of Liabilities," Working Paper, Universidad de Alicante, Alicante, Spain .

Petersen, M.A. and R.G. Rajan. 2000. "The Information Revolution and Small Business Lending: Does Distance Still Matter?" University of Chicago working paper.

Schaffnit, C., D. Rosen, and J.C. Paradi. 1997. "Best Practice Analysis of Bank Branches: An Application of DEA in a Large Canadian Bank," *European Journal of Operational Research* 98: 269-289.

Sealey, C.W., Jr. and J.T. Lindley. 1977. "Inputs, Outputs, and a Theory of Production and Cost at Depository Financial Institutions." *Journal of Finance* 32(4): 1251-1266.

Sherman, D., and F. Gold. 1995. "Branch Operating Efficiency: Evaluation with Data Envelopment Analysis", *Journal of Banking and Finance*, 9: 297-315.

Sherman, D., and G. Ladino. 1995. "Managing Bank Productivity Using Data Envelopment Analysis (DEA)", *Interfaces*, 25: 60-73.

Spong, K., R. J. Sullivan, and R. DeYoung. 1995. "What Makes a Bank Efficient? A Look at Financial Characteristics and Bank Management and Ownership Structure." Federal Reserve Bank of Kansas City, *Financial Industry Perspectives*, December: 1-19.

Tulkens, H. 1993. "On FDH Efficiency Analysis: Some Methodological Issues and Applications to Retail Banking, Courts, and Urban Transit", *Journal of Productivity Analysis,* 4: 183-210.

Tulkens, H., and A. Malnero. 1994. "Nonparametric Approaches to the Assessment of the Relative Efficiency of Bank Branches", working paper, Center for Operations Research and Econometrics, Universite Catholique de Louvain, Belgium.

Vander Vennet, R. 1996. "The Effect of Mergers and Acquisitions on the Efficiency and Profitability of EC Credit Institutions." *Journal of Banking and Finance* 20(9): 1531-1558.

Vassiglou, M., and D. Giokas. 1990. "A Study of the Relative Efficiency of Bank Branches: An Application of Data Envelopment Analysis," Journal of the Operational Research Society 41: 591-97.

Winton, A. 1999. "Don't Put All Your Eggs in One Basket? Diversification and Specialization in Lending." University of Minnesota.

Zenios, C., S. Zenios, K. Agathocleous, and A. Soteriou. 1996. "Benchmarks of the Efficiency of Bank Branches", working paper, University of Cyprus, Nicosia, Cyprus.

Table 1
Correlation Analysis of Bank ROE Among US Regions
Annual data, 1979-1998

Region (mean ROE)	**Region:** **New England**	**Mideast**	**Great Lakes**	**Plains**	**Southeast**	**Southwest**	**Rocky Mts.**	**Far West**
New England (0.106949)	1							
Mideast (0.106738)	0.65875	1						
Great Lakes (0.120448)	0.02411	0.5008	1					
Plains (0.131574)	0.10756	0.44102	0.66704	1				
Southeast (0.126031)	0.84124	0.66657	0.25513	0.3825	1			
Southwest (0.090953)	0.23662	0.60174	0.25345	0.69174	0.36296	1		
Rocky Mts. (0.121841)	0.2603	0.4899	0.4365	0.90354	0.46883	0.8772	1	
Far West (0.107647)	-0.28249	0.28071	0.69177	0.56564	0.07846	0.32124	0.39953	1

Sources: U.S. bank Call Reports, U.S. Bureau of Economic Analysis (BEA).

Return on equity (ROE) = the aggregate net income for the banks in the region, divided by the aggregate book value of equity for the banks in the region.

Regions: New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont); Mideast (Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania); Great Lakes (Illinois, Indiana, Michigan, Ohio, Wisconsin); Plains (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota); Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia); Southwest (Arizona, New Mexico, Oklahoma, Texas); Rocky Mountain (Colorado, Idaho, Montana, Utah, Wyoming); Far West (Alaska, California, Hawaii, Nevada, Oregon, Washington).

Table 2

Summary Statistics
Banks for which Cost and Profit Efficiency were Calculated
Means and (Standard Deviations)

	Main Sample (assets > $100 million)	**Small Banks** (assets < $100 million)
Profits/assets	0.0259 (0.0124)	0.0269 (0.0083)
Costs/assets	0.0416 (0.0134)	0.0425 (0.0088)
Consumer loans/assets	0.1032 (0.1197)	0.0854 (0.0593)
Business loans/assets	0.1470 (0.0953)	0.1715 (0.1064)
Real estate loans/assets	0.3441 (0.1414)	0.2967 (0.1327)
Securities/assets	0.3910 (0.1285)	0.4327 (0.1317)
Off-balance sheet/assets	0.0273 (0.0439)	0.0064 (0.0111)
Equity/assets	0.0913 (0.0317)	0.1023 (0.0337)
Market nonperforming loans/assets	0.000006985 (0.000004829)	0.00005809 (0.00005994)
Price of purchased funds	0.0402 (0.0035)	0.0392 (0.0039)
Price of core deposits	0.0212 (0.0060)	0.0246 (0.0065)
Price of labor ($ thousands, 1998)	40.8716 (8.9313)	37.1550 (6.1674)
Gross total assets ($ millions, 1998)	2,123.76 (12,308.44)	60.15 (39.22)
Number of banks	1,540	6,331
Number of bank-year observations	9,240	37,986

Notes: Costs, profits, variable outputs, fixed outputs, and fixed inputs were all scaled by gross total assets for expository purposes in this table only, not in the regressions.

Table 3

Cost and Profit Efficiency by Geographic Location of Bank

	Main Sample N=1,540 (greater than $100 million in assets)		**Small Banks** N=6,331 (less than $100 million in assets)	
Banks that are located...	COSTEFF	PROFEFF	COSTEFF	PROFEFF
(a) in the same region as their parent organization.	0.778 1439 0.0023	0.663 1439 0.0044	0.763 6214 0.0011	0.668 6214 0.0019
(b) in a different region than their parent organization.	0.805 ** 101 0.0117	0.668 101 0.0221	0.810 *** 117 0.0097	0.682 117 0.0189
(c) in a region that is contiguous to their parent organization.	0.820 *** 73 0.0138	0.685 73 0.0233	0.817 *** 94 0.0098	0.700 ** 94 0.0169
(d) in a region not contiguous to their parent organization.	0.767 28 0.0208	0.624 28 0.0514	0.782 23 0.0284	0.609 23 0.0656

The three numbers in each cell are the mean efficiency, the number of observations, and the standard error of the subsample mean. The location of the "parent organization" is determined by the location of the lead bank for banks affiliated with multi-bank holding companies, or by the location of the bank itself for banks that are either unaffiliated or are the sole bank in a one-bank holding company.

***, **, and * indicate that cell mean is significantly higher than the cell in top row at the 1%, 5%, and 10% levels.

Regions: New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont); Mideast (Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania); Great Lakes (Illinois, Indiana, Michigan, Ohio, Wisconsin); Plains (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota); Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia); Southwest (Arizona, New Mexico, Oklahoma, Texas); Rocky Mountain (Colorado, Idaho, Montana, Utah, Wyoming); Far West (Alaska, California, Hawaii, Nevada, Oregon, Washington).

The New England region is contiguous with Mideast region.
The Mideast region is contiguous with New England, Great Lakes, and Southeast regions.
The Great Lakes region is contiguous with Mideast, Plains, and Southeast regions.
The Plains region is contiguous with Great Lakes, Southeast, Southwest, and Rocky Mountain regions.
The Southwest region is contiguous with Plains, Southeast, Southwest, and Far West regions.
The Rocky Mountain region is contiguous with Plains, Southwest, and Far West regions.
The Far West region is contiguous with Southwest and Rocky Mountain regions.

Table 4

Cost and Profit Efficiency of Banks by Geographic Spread of Parent Organization
(Table excludes banks located in a different region from their lead bank.)

Home-region banks whose parent organizations own...	**Main Sample** N=1,439 banks (greater than $100 million in assets)		**Small Banks** N=6,214 home region banks (less than $100 million in assets)	
	COSTEFF	PROFEFF	COSTEFF	PROFEFF
(a) *only* banks in the same region.	0.773 1225 0.0024	0.660 1225 0.0047	0.761 6016 0.0011	0.667 6016 0.0019
(b) banks in other regions.	0.808 *** 214 0.0064	0.681 * 214 0.0111	0.823 *** 198 0.0065	0.714 *** 198 0.0127
(c) banks in contiguous regions.	0.801 *** 133 0.0081	0.700 *** 133 0.0132	0.818 *** 157 0.0071	0.729 *** 157 0.0145
(d) banks in noncontiguous regions.	0.821 *** 81 0.0103	0.651 81 0.0196	0.844 *** 41 0.0151	0.657 41 0.0245

The three numbers in each cell are the mean efficiency, the number of observations, and the standard error of the subsample mean. The location of the "parent organization" is determined by the location of the lead bank for banks affiliated with multi-bank holding companies, or by the location of the bank itself for banks that are either unaffiliated or are the sole bank in a one-bank holding company.

***, **, and * indicate that cell mean is significantly higher than the cell in top row at the 1%, 5%, and 10% levels.

Regions: New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont); Mideast (Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania); Great Lakes (Illinois, Indiana, Michigan, Ohio, Wisconsin); Plains (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota); Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia); Southwest (Arizona, New Mexico, Oklahoma, Texas); Rocky Mountain (Colorado, Idaho, Montana, Utah, Wyoming); Far West (Alaska, California, Hawaii, Nevada, Oregon, Washington).

The New England region is contiguous with Mideast region.
The Mideast region is contiguous with New England, Great Lakes, and Southeast regions.
The Great Lakes region is contiguous with Mideast, Plains, and Southeast regions.
The Plains region is contiguous with Great Lakes, Southeast, Southwest, and Rocky Mountain regions.
The Southwest region is contiguous with Plains, Southeast, Southwest, and Far West regions.
The Rocky Mountain region is contiguous with Plains, Southwest, and Far West regions.
The Far West region is contiguous with Southwest and Rocky Mountain regions.

Table 5
Summary Statistics for Banks used in Efficiency Regressions, Equation (6).

		425 non-lead banks in main sample		1,277 non-lead banks in small-bank sample	
Dependent variables:		**mean**	**std. dev.**	**Mean**	**std. dev.**
NONLEADEFF (PROFEFF)	Profit efficiency of non-lead banks in multibank BHCs.	0.6994	0.1697	0.7011	0.1534
NONLEADEFF (COSTEFF)	Cost efficiency of non-lead banks in multibank BHCs.	0.8099	0.0948	0.8016	0.0926
Exogenous variables:		**mean**	**std. dev.**	**Mean**	**std. dev.**
LEADEFF (PROFEFF)	Profit efficiency of lead bank (largest bank in the BHC).	0.5906	0.1959	0.6834	0.1492
LEADEFF (COSTEFF)	Cost efficiency of lead bank (largest bank in the BHC).	0.7770	0.0921	0.7853	0.0835
DISTANCE	Distance in miles between affiliate and lead bank.	310.52	451.08	136.47	247.17
lnDISTANCE	Natural log of (DISTANCE+1).	4.4761	2.1593	3.8043	1.8852
SAMESTATE	=1 if affiliate and lead bank are in the same state.	0.5075	0.4922	0.8099	0.3822
MSA	=1 if affiliate is in a Metropolitan Statistical Area (MSA).	0.7361	0.4391	0.3235	0.4667
HERF	Average Herfindahl index, weighted by share of affiliate deposits in each MSA or non-MSA county in which it operates.	0.1856	0.0928	0.2573	0.1697
BKASS	Bank gross total assets (thousands of 1998 dollars).	1,228,302	6,181,149	38,186	23,565
lnBKASS	Natural log of BKASS.	12.7496	1.2320	10.3351	0.6975
HCASS	Sum of BKASS for all bank affiliates in holding company.	18,512,914	31,362,826	1,293,720	5,379,763
lnHCASS	Natural log of HCASS.	15.5522	1.6357	12.3892	1.5322
BKMERGE	=1 if affiliate in merger, 1990-97.	0.1859	0.3895	0.0227	0.1490
HCMERGE	=1 if high holding company made acquisition, 1990-97.	0.1035	0.3050	0.1308	0.3373
REGION1	=1 if affiliate in New England	0.0258	0.1589	0.0039	0.0625
REGION2	=1 if affiliate in Mideast	0.1459	0.3534	0.0180	0.1330
REGION3	=1 if affiliate in Great Lakes	0.2341	0.4233	0.2136	0.4098
REGION4	=1 if affiliate in Plains	0.1365	0.3437	0.3038	0.4601
REGION5	=1 if affiliate in Southeast	0.2671	0.4423	0.2539	0.4353
REGION6	=1 if affiliate in Southwest	0.0867	0.2811	0.1299	0.3364
REGION7	=1 if affiliate in Rocky Mts.	0.0541	0.2265	0.0596	0.2367
REGION8	=1 if affiliate in Far West	0.0498	0.2170	0.0171	0.1293
UNMAPPEDL	=1 if location is missing for lead bank (location is assigned to state's largest city or banking center).	0.1204	0.3078	0.3592	0.4576
UNMAPPEDNL	=1 if location is missing for affiliate bank (location is assigned to state's largest city or banking center).	0.3278	0.4654	0.3637	0.4774

Table 6 -- Regression Estimates for Equation (6)

***, **, and * indicate significant difference from zero at 1%, 5%, and 10% levels.

Efficiency concept:	COSTEFF	PROFEFF	COSTEFF	PROFEFF
Sample:	main	main	small bank	small bank
Intercept	-0.2387	-0.4140	-0.7980 *	-1.0473
	(0.5518)	(0.9139)	(0.4428)	(0.7039)
LEADEFF	0.3181 ***	0.3133 ***	0.3243 ***	0.2631 ***
	(0.1148)	(0.0833)	(0.0660)	(0.0618)
LnDISTANCE	0.0173	0.0044	0.0295 **	0.0125
	(0.0179)	(0.0109)	(0.0125)	(0.0097)
LEADEFF*lnDISTANCE	-0.0264	-0.0085	-0.0398 **	-0.0161
	(0.0226)	(0.0168)	(0.0159)	(0.0138)
SAMESTATE	0.0141	0.0693 ***	0.0116	0.0215 *
	(0.0134)	(0.0223)	(0.0076)	(0.0121)
MSA	0.0107	-0.0022	0.0011	-0.0172 *
	(0.0139)	(0.0232)	(0.0063)	(0.0101)
HERF	-0.1103 **	0.2948 ***	-0.0112	0.0657 **
	(0.0575)	(0.0958)	(0.0185)	(0.0295)
LnBKASS	-0.0037	-0.0693	0.1654 *	0.2840 **
	(0.0687)	(0.1145)	(0.0879)	(0.1400)
½lnBKASS^2	-0.0005	0.0030	-0.0181 **	-0.0265 *
	(0.0050)	(0.0083)	(0.0086)	(0.0137)
LnHCASS	0.1061 **	0.1398	0.0803 ***	-0.0154
	(0.0523)	(0.0877)	(0.0232)	(0.0372)
½lnHCASS^2	-0.0060 *	-0.0066	-0.0048 ***	0.0015
	(0.0034)	(0.0056)	(0.0017)	(0.0028)
BKMERGE	0.0198	0.0521 **	0.0374 **	0.0669 **
	(0.0122)	(0.0202)	(0.0171)	(0.0273)
HCMERGE	0.0082	0.0098	-0.0036	0.0340 ***
	(0.0152)	(0.0253)	(0.0075)	(0.0120)
REGION1	0.0314	0.0704	0.0146	0.1334 *
	(0.0345)	(0.0575)	(0.0441)	(0.0703)
REGION2	-0.0154	0.0506	-0.0057	0.0226
	(0.0250)	(0.0410)	(0.0271)	(0.0434)
REGION3	-0.0175	0.0553	-0.0018	0.0485
	(0.0237)	(0.0391)	(0.0203)	(0.0325)
REGION4	-0.0073	0.0657 *	0.0006	0.0537 *
	(0.0240)	(0.0398)	(0.0202)	(0.0322)
REGION5	-0.0193	0.1261 ***	-0.0196	0.0963 ***
	(0.0228)	(0.0377)	(0.0201)	(0.0320)
REGION6	-0.0358	0.1178 ***	-0.0131	0.1423 ***
	(0.0253)	(0.0418)	(0.0205)	(0.0328)
REGION7	0.0042	0.1503 ***	-0.0061	0.1545 ***
	(0.0279)	(0.0468)	(0.0222)	(0.0358)
UNMAPPEDNL	-0.0001	0.0140	-0.0071	0.0168 *
	(0.0121)	(0.0203)	(0.0058)	(0.0092)
UNMAPPEDL	0.0077	0.0264	-0.0042	0.0046
	(0.0175)	(0.0283)	(0.0057)	(0.0092)
N	425	425	1277	1277
R-square	0.1377	0.2382	0.1011	0.1665
adjusted R-square	0.0927	0.2004	0.0861	0.1526

Table 7
Evaluating ∂NONLEADEFF/∂LEADEFF as mean DISTANCE increases.
***, **, and * indicate significant difference from zero at 1%, 5%, and 10% levels.

Efficiency concept:	COSTEFF	PROFEFF	COSTEFF	PROFEFF
Sample:	Main	main	small bank	Small bank
minimum DISTANCE in sample:	0 miles	0 miles	0 miles	0 miles
point estimate of derivative	0.3182 ***	0.3133 ***	0.3243 ***	0.2631 ***
standard error of derivative	0.1148	0.0833	0.0666	0.0618
banks in same state:	73 miles	73 miles	81 miles	81 miles
point estimate of derivative	0.2053 ***	0.2769 ***	0.1499 ***	0.1925 ***
standard error of derivative	0.0532	0.0441	0.0323	0.0298
banks in same region, different states:	288 miles	288 miles	188 miles	188 miles
point estimate of derivative	0.1688 ***	0.2652 ***	0.1161 ***	0.1789 ***
standard error of derivative	0.0591	0.0503	0.0387	0.0342
banks in contiguous regions:	597 miles	597 miles	368 miles	368 miles
point estimate of derivative	0.1495 **	0.2590 ***	0.0893 *	0.1680 ***
standard error of derivative	0.0681	0.0573	0.0461	0.0399
banks in noncontiguous regions:	1297 miles	1297 miles	1278 miles	1278 miles
point estimate of derivative	0.1495 **	0.2590 ***	0.0893 *	0.1680 ***
standard error of derivative	0.0681	0.0573	0.0461	0.0399
maximum DISTANCE in sample:	2825 miles	2825 miles	3303 miles	3303 miles
point estimate of derivative	0.1084	0.2458 ***	0.0018	0.1327 **
standard error of derivative	0.0942	0.0767	0.0757	0.0645

Figure 1
Derivative of affiliate bank efficiency (NONLEADEFF) with respect to lead bank efficiency (LEADEFF). Based on Table 4 regression estimates.

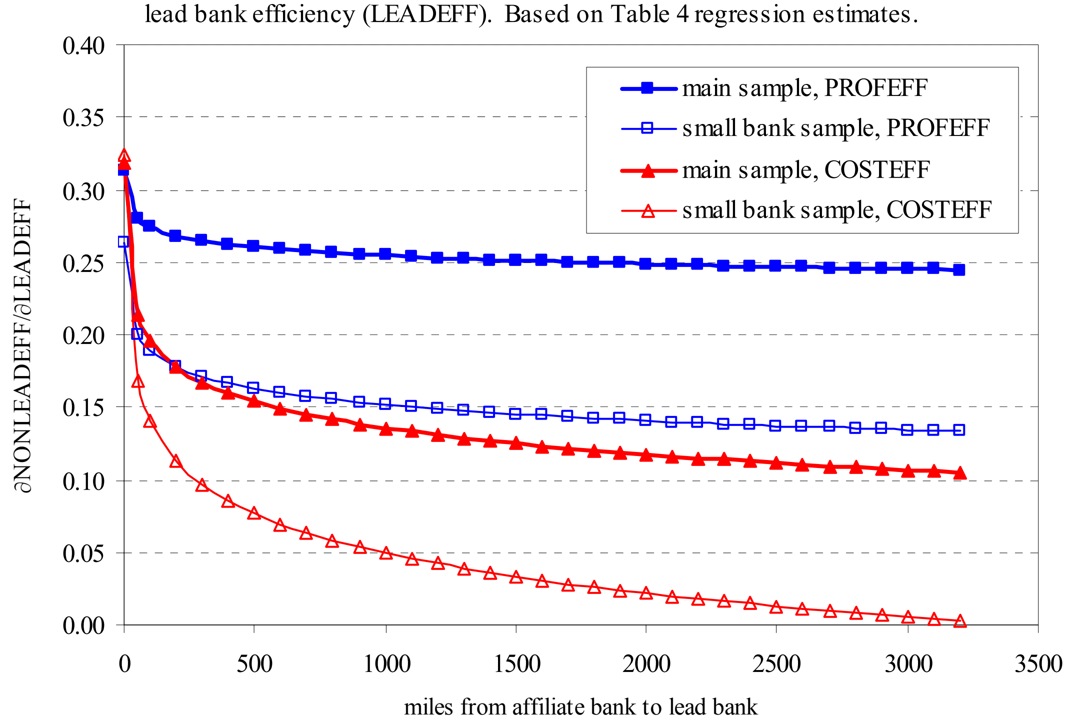

Table 8
Selected Regression Results for Subsample Estimates of Equation (6)
***, **, and * indicate significant difference from zero at 1%, 5%, and 10% levels.

dependent variable:	COSTEFF	PROFEFF	COSTEFF	PROFEFF
sample:	main	main	small bank	small bank
(a) full sample:				
LEADEFF	0.1996 ***	0.2774 ***	0.1760 ***	0.1996 ***
	(0.0530)	(0.0441)	(0.0308)	(0.0291)
lnDISTANCE	-0.0031	0.0005	-0.0018	0.0015
	(0.0031)	(0.0052)	(0.0016)	(0.0026)
N	425	425	1277	1277
R-square	0.1348	0.2552	0.0966	0.1656
Adjusted R-square	0.0919	0.2183	0.0822	0.1524
(b) out-of-state affiliates only:				
LEADEFF	0.1098	0.3898 ***	0.0759	0.0840
	(0.0903)	(0.0725)	(0.0843)	(0.0786)
lnDISTANCE	-0.0037	-0.0420 **	-0.0128 *	-0.0015
	(0.0108)	(0.0168)	(0.0073)	(0.0135)
N	207	207	244	244
R-square	0.0931	0.2697	0.1181	0.2303
Adjusted R-square	-0.0045	0.1912	0.0390	0.1612
(c) out-of-region affiliates only:				
LEADEFF	0.1400	0.5008 ***	0.2748 **	0.4002 ***
	(0.1390)	(0.1123)	(0.1152)	(0.1072)
lnDISTANCE	-0.0063	-0.0492 *	-0.0266 **	-0.0145
	(0.0163)	(0.0267)	(0.0106)	(0.0195)
N	113	113	127	127
R-square	0.1893	0.3556	0.3184	0.3793
Adjusted R-square	0.0130	0.2156	0.1973	0.2690
(d) noncontiguous region affiliates only:				
LEADEFF	0.6325	0.9141 ***	0.5471	0.6042
	(0.4288)	(0.1389)	(0.5674)	(0.6298)
lnDISTANCE	0.0007	0.1189	0.0878	0.2562
	(0.0760)	(0.0874)	(0.0862)	(0.4075)
N	31	31	25	25
R-square	0.5258	0.8963	0.8477	0.6949
Adjusted R-square	-0.0162	0.7778	0.5938	0.1864

Table 9.1
Cost Efficiency, Individual Organization Analysis

Data for banks in 33 BHCs that own at least 10 affiliate banks, ordered by the mean cost efficiency of those affiliates. "Statewide" BHCs only own affiliates in their home states. "Regional" BHCs own affiliates outside their home states, but not beyond their home regions. "Superregional, contiguous" BHCs own affiliates outside their home regions, but not beyond regions that are contiguous to the BHC. "Superregional, noncontiguous" BHCs own affiliates outside their home regions, including regions that are not contiguous to the BHC. The superscript ^{A} indicates a mean cost efficiency greater than 0.7989, which is the mean COSTEFF for all affiliates of multi-bank holding companies in our data. The superscript ^{B} indicates a BHC whose affiliates have mean cost efficiencies greater than 0.7989 in each of the geographic locations in which it operates.

(1) Geographic scope of BHC	(2) Number of banks in BHC	(3) Mean cost efficiency for all banks in BHC:	Mean cost efficiency for banks located in: (4) home state of BHC	(5) home region (but not in home state) of BHC	(6) regions contiguous to BHC	(7) regions not contiguous to BHC
superregional, contiguous ^{B}	21	.9295	.9274 ^{A}		.9721 ^{A}	
statewide ^{B}	13	.9027	.9027 ^{A}			
superregional, contiguous ^{B}	15	.8987	.8979 ^{A}	.8341 ^{A}	.9232 ^{A}	
superregional, contiguous ^{B}	15	.8908	.9097 ^{A}	.8355 ^{A}	.8648 ^{A}	
superregional, contiguous ^{B}	16	.8822	.8089 ^{A}	.8699 ^{A}	.8989 ^{A}	
superregional, noncontiguous	26	.8733	.8772 ^{A}			.7775
statewide ^{B}	10	.8683	.8683 ^{A}			
superregional, noncontiguous	27	.8639	.8734 ^{A}			.6167
superregional, contiguous	15	.8601	.8662 ^{A}		.7750	
statewide ^{B}	10	.8356	.8356 ^{A}			
superregional, noncontiguous ^{B}	34	.8349	.8087 ^{A}	.8784 ^{A}	.8283 ^{A}	.8598 ^{A}
regional ^{B}	28	.8285	.8181 ^{A}	.8343 ^{A}		
regional ^{B}	10	.8275	.8041 ^{A}	.8509 ^{A}		
superregional, contiguous ^{B}	10	.8255	.8073 ^{A}		.9893 ^{A}	
superregional, noncontiguous	13	.8240	.8890 ^{A}	.8192 ^{A}	.6613	.7643
superregional, contiguous	12	.8215	.8339 ^{A}	.7918	.8388 ^{A}	
superregional, contiguous	10	.8207	.7146	.8995 ^{A}	.8528 ^{A}	
regional ^{B}	12	.8140	.8221 ^{A}	.8114 ^{A}		
superregional, contiguous	13	.9132	.8093 ^{A}	.7904	.8539 ^{A}	
superregional, noncontiguous	12	.9126	.8688 ^{A}	.8291 ^{A}	.8714 ^{A}	.6479
superregional, noncontiguous	20	.8103	.8205 ^{A}	.7077	.9006 ^{A}	.7681
superregional, contiguous	15	.8029	.7906	.8451 ^{A}	.7823	
superregional, contiguous	21	.7995	.8198 ^{A}	.6681	.7279	
statewide ^{B}	13	.7994	.7994 ^{A}			
superregional, contiguous	22	.7974	.8006 ^{A}	.8051 ^{A}	.7262	
superregional, contiguous	10	.7889	.7946		.7659	
superregional, contiguous	10	.7882	.7782		.8786 ^{A}	
regional	35	.7834	.7655	.8138 ^{A}		
superregional, contiguous	13	.7829	.8808 ^{A}	.7626	.7914	
statewide	10	.7745	.7745			
superregional, contiguous	11	.7675	.7613		.7751	
superregional, contiguous	12	.7494	.7515	.6987	.7980	
superregional, contiguous	10	.7387	.7416	.7152	.7493	

Table 9.2
Profit Efficiency, Individual Organization Analysis

Data for banks in 33 BHCs that own at least 10 affiliate banks, ordered by the mean profit efficiency of those affiliates. "Statewide" BHCs only own affiliates in their home states. "Regional" BHCs own affiliates outside their home states, but not beyond their home regions. "Superregional, contiguous" BHCs own affiliates outside their home regions, but not beyond regions that are contiguous to the BHC. "Superregional, noncontiguous" BHCs own affiliates outside their home regions, including regions that are not contiguous to the BHC. The superscript [A] indicates a mean profit efficiency greater than 0.6931, which is the mean PROFEFF for all affiliates of multi-bank holding companies in our data. The superscript [B] indicates a BHC whose affiliates have mean profit efficiencies greater than 0.6931 in each of the geographic locations in which it operates.

(1) Geographic scope of BHC	(2) Number of banks in BHC	(3) Mean profit efficiency for all banks in BHC:	Mean profit efficiency for banks located in: (4) home state of BHC	(5) home region (but not in home state) of BHC	(6) regions contiguous to BHC	(7) regions not contiguous to BHC
superregional, contiguous	21	.9051	.9173 [A]		.6603	
superregional, contiguous	15	.8448	.8944 [A]	.6368	.8178 [A]	
regional [B]	35	.8036	.8008 [A]	.8084 [A]		
superregional, noncontiguous [B]	34	.7892	.7281 [A]	.7794 [A]	.8242 [A]	.6999 [A]
statewide [B]	10	.7858	.7848 [A]			
superregional, contiguous	16	.7828	.6891	.9040 [A]	.7667 [A]	
superregional, noncontiguous [B]	26	.7746	.7697 [A]			.8973 [A]
superregional, contiguous [B]	13	.7648	.7303 [A]	.8824 [A]	.8021 [A]	
superregional, noncontiguous	12	.7449	.8168 [A]	.7622 [A]	.7149 [A]	.6512
statewide [B]	13	.7419	.7419 [A]			
regional [B]	12	.7308	.7231 [A]	.7333 [A]		
superregional, contiguous	12	.7278	.6709	.6566	.8564 [A]	
superregional, contiguous	13	.7231	.6395	.7370 [A]	.7514 [A]	
regional [B]	28	.7166	.7304 [A]	.7089 [A]		
superregional, contiguous [B]	11	.7129	.7264 [A]		.6966 [A]	
superregional, noncontiguous	13	.7121	.6819	.8406 [A]	.6985 [A]	.7025 [A]
superregional, contiguous	22	.7110	.7182 [A]	.7065 [A]	.5725	
superregional, contiguous	21	.7105	.7269 [A]	.7160 [A]	.6150	
superregional, contiguous	10	.7006	.7007 [A]	.7227 [A]	.6817	
superregional, noncontiguous	20	.6939	.5153	.7342 [A]	.7125 [A]	.7348 [A]
superregional, contiguous	10	.6920	.6931		.6875	
superregional, contiguous	15	.6909	.7299 [A]	.5184	.6058	
statewide	10	.6861	.6861			
regional	10	.6791	.6578	.7005 [A]		
superregional, contiguous	10	.6662	.6693		.6389	
superregional, contiguous	15	.6642	.6433	.6693	.6958 [A]	
superregional, contiguous	15	.6197	.6331		.8823 [A]	
superregional, contiguous	10	.6462	.6439		.6667	
superregional, contiguous	10	.6349	.6872	.7585 [A]	.4654	
superregional, contiguous	12	.6238	.5603	.6161	.6952 [A]	
statewide	10	.6166	.6166			
statewide	13	.5847	.5847			
superregional, noncontiguous	27	.5644	.5671			.4947