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The Competitive Dynamics of Geographic Deregulation in Banking: Implications for Productive Efficiency

Deregulation of geographic restrictions in banking over the past 20 years has intensified both potential and actual competition in the industry. The accumulating empirical evidence suggests that potential efficiency gains associated with consolidating banks are often not realized. We evaluate the impact of this increased competition on the productive efficiency of non-merging banks confronted with new entry in their local markets and find that the incumbent banks respond by improving cost efficiency. Thus, studies evaluating the impact of bank mergers on the efficiency of the combining parties alone may be overlooking the most significant welfare-enhancing aspect of merger activity.

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LOCAL BANKING MARKETS in the United States have historically been protected from entry through a complex set of state and federal regulations. Significant industry consolidation, mostly in the form of mergers and acquisitions

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(M&As), has followed the deregulation that took place over the past two decades. Indeed, M&A activity has been substantial over this period with some 350 bank mergers per year during the 1980s, expanding to over 550 per year during the 1990s. Although most of these involve smaller banks, interest in the impact of mergers has been significant and has recently been renewed with the combination of larger banks.

There is significant disagreement as to the effect of this M&A activity. Economic theory suggests that mergers can be an efficient means to restructure the industry, allowing inefficient banks to exit and more efficient firms to obtain efficient scale. However, the evidence on the welfare gains from merger activity has been mixed, at best. Indeed, as studies find relatively minor cost savings and adverse effects on the stock value of the acquiring firm, recent research has questioned the motives of the management of acquiring banks. There appears to be limited evidence of efficiency gains resulting from the recent increase in bank merger activity.

While previous research has evaluated the productive efficiency gains of merging banks, we take a broader perspective and evaluate benefits induced by changes in potential and actual competition brought on by geographic deregulation and actual bank consolidation. Ours is a more comprehensive, micro-oriented approach that examines a group of banks whose behavior is expected to be indirectly affected by bank M&As: incumbent banks (i.e., non-merging banks that operate in the same local market as the acquired bank). We examine changes in the performance of these incumbents following M&As. Our priors are that external entry into a market via an M&A, or within-market consolidation that creates a more viable competitor, will generate competitive pressure for incumbent banks to improve their operational efficiency. While the bank productive efficiency research and the bank M&A literature are rather extensive, most of the analysis has considered the impact on the individual merging banks. The effect of entry on the efficiency of incumbent banks has not received much attention. If one is interested in the potential welfare implications of bank merger activity, however, incumbents' efficiency gains in reaction to consolidation may dominate the impact found from concentrating exclusively on the individual merging parties.

While our focus is on the impact of M&As on incumbent banks, our research also accounts for the fact that banks may improve efficiencies following deregulation in anticipation of eventual entry, and resulting increased competition, in their markets. Whether banks improve their productive efficiency in anticipation of future market entry following deregulation or whether they wait until actual entry occurs is an empirical question that we address.

The paper proceeds as follows. In Section 1, we discuss the bank merger literature and align our work within that literature. In Section 2, our methodology and data sources are discussed. Our empirical findings are discussed in Section 3, and Section 4 concludes.

1. BACKGROUND AND MOTIVATION

The banking industry has long been considered an ideal laboratory for analyzing industry structure issues because of the relatively well-defined local banking

markets and the availability of data collected by the regulators.[1] Studies of the traditional structure–conduct–performance paradigm in banking evaluating the impact of market structure on profitability and prices generally find evidence consistent with the paradigm: higher market concentration results in higher loan rates, lower deposit rates, and greater profitability, although the magnitude of the correlation is often small (Rhoades 1981, Gilbert 1984, Smirlock 1985, Jappelli 1987, Evanoff and Fortier 1988, Berger and Hannan 1989, Hannan 1991, Corvoisier and Gropp 2002).

As the bank consolidation trend accelerated in recent years (see Tables 1–3) there has been a renewed interest in evaluating the potential impact of market structure changes resulting from this activity. The most common justification for recent mergers is that they are expected to result in cost reductions and superior operating efficiency. For years, the potential benefits resulting from mergers were evaluated by estimating the potential efficiency gains to be realized from scale economies. Most of the bank cost literature, however, found that scale advantages were exhausted at relatively low levels of outputs and nearly constant returns to scale were rather common in the industry (for literature reviews see Evanoff and Israilevich 1991, Berger, Hunter, and Timme 1993, Berger and Humphrey 1997, Berger, Demsetz, and Strahan 1999).[2] More recently, studies have evaluated the impact of bank mergers on the potential improvement in operating efficiency measured with either standard cost accounting ratios or as technical inefficiency representing production away from the estimated efficient cost frontier. Many of these studies find that while there appears to be significant potential efficiency gains from mergers (Rhoades 1993, Shaffer 1993, Kohers, Huang, and Kohers 2000) the gains typically are not realized (Berger and Humphrey 1992, Srinivasan and Wall 1992, Linder and Crane 1993, Rhoades 1993, 1994, 1998, Shaffer 1993, Peristiani 1997, Focarelli, Panetta, and Salleo 2002).[3] Thus, it can be argued that the most commonly argued benefit of bank mergers does not appear to have materialized.

Alternatively, a "catch-all" methodology to evaluate the impact of bank mergers would be to analyze how the stock market appraises the value of the acquisition. It may be that gains from either cost savings or from other merger benefits, such as diversification, or shifts in the risk–return trade-off, are indeed realized and viewed favorably by shareholders. This second strand of literature, however, is typically no more suggestive of merger benefits than is the cost efficiency literature. Hannan and Wolken (1989) and Houston and Ryngaert (1994) found that the merger announcements

1. The local geographic market (the county or Metropolitan Statistical Area (MSA)) has typically been considered the relevant banking market for antitrust purposes and, therefore, for the evaluation of industry structure issues (see *United States v. Philadelphia National Bank,* 1963). In the past, regulation limited banks' expansion outside of the local market. As a result, the local market was the major source of deposits. Further, banks' soft information on local customers caused the market for certain loans, such as small business loans, to be local. Because of recent industry deregulation and technological innovations, the significance of the local market has probably declined. However, regulators still give the local markets significant consideration for antitrust purposes; see Hannan (1991) and Gilbert and Zaretsky (2003).

2. An exception to this finding is the work of Hughes and Mester (1998).

3. Again, there are exceptions: see Fixler and Zieschang (1993), Berger and Humphrey (1997), Hughes et al. (1999), and Cornett and Tehranian (1992).

TABLE 1

MERGERS AND ACQUISITION SAMPLE STATISTICS: BREAKDOWN OF MERGERS AND ACQUISITIONS BY ORGANIZATIONAL STRUCTURE TYPE

Type of M&A	Number of M&As
Within-BHC M&As	3,570
Across-BHC M&As	3,378
Independent bank M&As	78
BHC acquiring independent bank	68
Independent bank acquiring a BHC unit	837
Total	7,931

NOTES: Sample information covers 1984–99. The merger and acquisition (M&A) information comes from the Board of Governors of the Federal Reserve System's M&A data set. The sample includes all M&As in the Board's data set with the exception of government-assisted M&As.

TABLE 2

MERGERS AND ACQUISITION SAMPLE STATISTICS: BREAKDOWN OF MERGERS AND ACQUISITIONS BY ENTRY TYPE

	Number of M&As
Within-market M&As	4,411
Out-of-market M&As	2,438
Within-state M&As	5,622
Out-of-state M&As	2,309

NOTES: Market is defined as the CMSA, MSA, or county. An institution's market is defined as the largest holder's market (the highest bank holding company if any exists, otherwise the institution itself). The number of observations in this table may not necessarily add up to 7,931, as we could not match some of the market definitions across (i) the Board's M&A data set, which spans the whole calendar year; (ii) the Federal Deposit Insurance Corporation's Summary of Deposits data set, collected each June; and (iii) the Call Reports, which are end-of-year reports.

actually lead to a *decrease* in the value of the acquiring firm's stock price. While increases in the acquired firm's stock price may partially offset this loss, studies of the net benefits typically suggest that either net losses are realized or, at best, the findings are inconclusive (see Rhoades 1994).[4]

These findings have led some to question the motives behind the recent proliferation of bank mergers. Piloff and Santomero (1998) discuss an array of potential reasons for why mergers may not lead to efficiency and economic gains including managerial hubris and agency problems between shareholders and bank managers.[5] Bliss and Rosen (2001) addressed the agency problem directly and found empirical support for the contention that mergers typically increase the wealth of the CEO at the expense

4. A few recent studies, however, have found evidence of positive stock market reactions for acquirers in certain subsamples of bank mergers (see DeLong 2001, Becher 2000, DeLong and DeYoung 2007). While equity price responses can be used to analyze a number of specific policy issues, since a relatively small fraction of banks have publicly traded stocks, and many of those are relatively thinly traded, it may be problematic to draw broad conclusions about the industry in general from analyses of this subsample of banks. For example, it would be essentially impossible to conduct analysis similar to ours using equity prices as the performance measure given the small sample issues and given the near impossibility of finding a publicly traded incumbent bank that has not been involved in a bank merger.

5. For a discussion of this concept see Roll (1986).

TABLE 3

M&A-Affected Market and Bank Statistics

Number of	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Bank observations (excludes banks involved in M&As)	11,844	10,003	9,636	9,204	8,899	8,635	8,522	8,324	7,942	7,709	7,396	7,044	6,553	6,458	6,122	5,846	130,137
M&As	350	353	323	533	599	410	381	422	458	594	593	659	588	646	589	463	7,931
Affected counties	95	84	99	98	154	158	134	114	138	134	187	210	169	184	173	142	2,273
Affected MSAs	70	79	77	103	95	81	84	92	85	112	113	129	107	131	129	86	1,573
Total affected markets	165	163	176	201	249	239	218	206	223	246	300	339	276	315	302	228	3,846
Incumbent banks in affected counties	201	168	232	218	280	326	291	272	294	296	398	273	266	297	229	213	4,254
Incumbent banks in affected MSAs	1,037	412	498	493	388	363	560	386	581	573	695	522	354	388	293	320	7,863
Incumbent banks total	1,238	580	730	711	668	689	851	658	875	869	1,093	795	620	685	522	533	12,117

Notes: Information on the number of M&As (row 2) is from the Fed's M&A data set and *includes* M&As involving non-banks. The number of affected banks is from the Call Reports and *excludes* non-commercial banks, as non-commercial banks are not analyzed in the study. Banks with negative book value of total assets (TA) or book value of equity are also deleted from the sample.

of shareholders. Brewer, Jackson, and Wall (2004) found that shareholders of the acquiring firm often lost wealth in a bank merger when the target CEO had a special "employment parachute" enabling her to obtain a position in the combined bank.[6] Finally, Penas and Unal (2004) and Shull and Hanweck (2002) argue that larger bank mergers are partially motivated by a desire to become "too big to fail." Thus, the literature suggests that there may be a number of reasons for merger activity other than shareholder value maximization or potential efficiency gains, bringing into question whether the commonly espoused benefits from mergers are realized.

We take a different approach to evaluating potential gains resulting from bank mergers. We believe that the past emphasis on the potential and realized efficiency gains of the merging parties has overlooked the largest potential benefit from M&As: the response of other *incumbent* banks to mergers affecting their local markets. Our basic contention is that increases in actual or potential merger activity should serve as a "wake-up call" to the managers of non-merging banks operating in the same market and place competitive pressure on them to improve operations in order to remain a viable competitor.

Although the impact of M&A activity on the efficiency of incumbent banks has not previously been analyzed, there is a literature considering the response of the merging parties and market incumbents in other dimensions. For example, in evaluating the impact of mergers on product pricing, Prager and Hannan (1998) found that both banks involved in horizontal mergers *and* their local rivals offered lower deposit rates (consistent with increased market power) compared to banks operating in markets with no M&A activity. Focarelli and Panetta (2003) found that deposit rates offered by the consolidating institution initially decreased but then increased by an amount more than sufficient to offset the initial decline. Rival banks operating in the same markets decreased rates during both the transition period and the period following the transition.

Concerning the impact of M&A activity on loan rates, Sapienza (2002) found that following within-market mergers, customers of acquired banks faced lower loan rates, although the effect was attenuated if the target bank was large. She attributed this to efficiency gains, which were not passed on when the target bank was sufficiently large and the merger resulted in increased market power. Kahn, Pennacchi, and Sopranzetti (2005) found similar results for rates on unsecured personal loans following mergers and attributed it to increased market power and few scale economies based on the "soft" information technology used to deliver this product. In contrast, auto loan rates were found to decrease following the merger, which they attributed to efficiency gains from scale economies given the commodity-like production process based on "hard" customer information. Finally, Panetta, Schivardi, and Shum (2004) found that following M&As the merging institutions adjusted the interest rates charged on loans to better align them with the risk of the borrower. Similarly, Focarelli, Panetta,

6. However, they do find evidence that "platinum" parachutes enhance the combined target/acquirer shareholder wealth. Similarly, Anderson, Becher, and Campbell (2004) find that *ex post* merger compensation changes are related to the combined value increase of the merging banks, and reject the empire building hypothesis.

and Salleo (2002) found that bank acquisitions lead to improved credit allocation and higher quality loan portfolios.

A related literature evaluates the impact of increases in potential competition.[7] Jayaratne and Strahan (1998) found that restrictions on the geographic expansion of banks "retarded the natural process of selection" whereby efficient banks expand at the expense of inefficient ones. Following deregulation, they found evidence of declines in non-performing loans, loan loss provisions, and charge-offs, and evidence that these improvements were passed on to consumers in the form of better loan rates. Using bank-level data, Stiroh and Strahan (2003) found that following deregulation, market shares were reallocated toward better performing institutions. The relationship was strongest in states that previously had the most restrictive regulations. Hannan and Prager (1998) found that the elimination of restrictions to intrastate multi-bank holding company expansion, interstate multi-bank holding company expansion, and interstate branching resulted in more competitive deposit interest rates. However, they did not find a similar impact with respect to the elimination of restrictions to intrastate branching (in fact they found evidence of a perverse effect). DeYoung, Hasan, and Kirchhoff (1998) found that following the deregulation of laws that restricted interstate and intrastate banking, local banks' productive efficiency initially deteriorated, but then improved over time. Finally, Daniels, Tirtiroglu, and Tirtiroglu (2005) found that restrictions to geographic expansion adversely affected the total factor productivity of U.S. banks over the 1971–95 period. Thus, the bulk of the evidence is consistent with the contention that actual and potential competition significantly influences the behavior of banks in the local market.

How does our study fit within this literature? Examining the cost efficiency of incumbent banks in the face of entry, we complement the strands of literature that examine the (i) efficiency of merging banks, (ii) deposit or loan rates for merging and incumbent institutions, and (iii) performance changes following market entry deregulation. Our basic contention is that an acquisition by a firm in a local market should serve to "wake up" management at other banks in that market as they incur competitive pressure to improve operations to remain a viable competitor. This potential may be particularly strong in the banking industry as past research has found acquiring banks to be relatively efficient, and thus, potentially, aggressive competitors. We would also expect that the elimination of entry barriers should result in efficiency gains as institutions realize that their local market will no longer be protected by regulation; i.e., greater *potential* competition now exists. Therefore, increases in both potential and actual competition should place pressure on *incumbent* banks to improve their operational efficiency. The first effect occurs when entry barriers are eliminated and the latter when consolidation actually takes place. We separately control each effect.

While our approach complements the research that has examined changes in deposit and loan rates in markets where M&As take place, we differ from previous research in

7. Most of these studies evaluate market behavior following deregulation, which would actually include potential and actual competition since it would incorporate all market changes (or lack of changes) following deregulation.

that we are not assessing the performance of the banks actually involved in a merger. Rather, we evaluate the parties that will be affected by the bank that is gaining a potentially more viable role in the local market. We are evaluating the most commonly claimed response to an increase in local competition: an attempt to maintain a viable presence by improving operational efficiency. While changes in pricing and profitability may follow, the initial incorporation of improved operations is the most fundamental response to the increased competition. Since we evaluate the impact on a larger number of banks, the welfare implications could be quite large. Even small efficiency improvements by a large number of incumbents could lead to substantial industry-wide cost savings.

2. METHODOLOGY AND DATA SOURCES

We examine the impact of M&As on the performance of incumbent banks in both urban (as defined by MSAs) and in rural banking markets (as defined by counties).[8] We use a two-step procedure to evaluate the impact. We first generate performance measures for all U.S. commercial banks. We then concentrate on non-merging banks in the markets where M&As occur and evaluate how their productive efficiency responds to the increased competition relative to that of a controlled sample of banks operating in markets without entry.

2.1 Stage 1: Performance Measures

Our primary measure of bank performance is cost X-efficiency derived from empirical estimates of a minimum-cost frontier for the population of banks in our panel, which covers 1984 through 1999. X-efficiency analysis, a standard benchmarking tool in empirical industrial economics, has been used in a large number of studies that examine the banking industry (see reviews by Berger, Hunter, and Timme 1993 and Berger and Humphrey 1997). The X-efficiency benchmark is our preferred method because it encompasses both technological and allocative efficiencies at the firm level. A technologically efficient bank would produce with minimum amounts of inputs given the level of outputs, or, equivalently, would produce the maximum amount of outputs for the given level of inputs. An allocatively efficient firm would select the appropriate mix of inputs and outputs given the prices it faces in its markets. As such, the empirical cost X-efficiency measure accounts for differences in the prices of inputs that the banks (which are price takers operating in competitive markets) face in their local markets, differences in the levels of outputs that they choose to produce, and differences in the fixed-netputs (such as different forms of capital) that

8. This definition of rural and urban banking markets is common in the literature. Recent analysis by Laderman and Pilloff (2007) suggests that this definition of banking markets produces similar results for structure-conduct-performance analysis as does market definitions defined for antitrust purposes by regulators based on more rigorous analysis of local commuting patterns, business transactions, and community trends. Thus, use of MSAs and non-MSA counties as banking markets appears appropriate.

banks can only change in the long term. An alternative procedure is to use accounting ratios. However, accounting ratios presume that "all else (i.e., input prices, output, and fixed-netput levels) is equal" across banks when, in fact, they are not. This could result in significant benchmarking errors (see DeYoung 1997). Nevertheless, we also evaluate the impact of M&As on an array of standard cost accounting ratios to get a better sense of the source of any efficiency gains.

M&As should have a direct effect on cost efficiency by forcing incumbent banks to more effectively combine factors of production and compete in the face of increased competition. We focus on the cost efficiency of the bank production process rather than the profit efficiency since the effect of M&As on the latter is ambiguous. Following an M&A in its market, the incumbent bank could improve cost efficiency to better compete but may also be required to respond to the new competition with enhanced service levels and price adjustments (as shown by Prager and Hannan 1998, Sapienza 2002, Focarelli and Panetta 2003, and Kahn, Pennacchi, and Sopranzetti 2005). While improved cost efficiency could lead to improved profit efficiency, improved service levels and better prices could hinder profit efficiency (relative to banks located in markets in which no such response was required). The extent to which banks are pressured to adjust service levels and output prices is also likely to vary with market characteristics such as the degree of market power. For example, an increase in market power could result in price increases (and a corresponding increase in profit efficiency), but with less competition bank managers could become more complacent, resulting in offsetting cost increases (the classic X-inefficiency argument). Thus, the net effect on profit efficiency is unclear.

Even though cost X-efficiency remains our preferred performance measure, it also has its weaknesses. Importantly, X-efficiency is a *relative* measure of performance rather than an *absolute* measure: each bank's performance is compared to that of firms following the best practices in the industry (after controlling for differences in input prices, output, and fixed-netput levels). Best practices in the industry help define a frontier that can be estimated using well-established empirical techniques. The higher (lower) the X-efficiency of a bank, the closer (more distant) that bank is to the best practices in the industry. It is possible that the true frontier could actually be positioned lower in the cost-input space as even the most efficient operating bank could incur inefficiencies. However, even as a relative measure, we believe that getting closer to the efficient frontier, wherever it may be, is a good indicator of increased efficiency.

We calculate cost X-efficiency measures after estimating a single minimum-cost frontier for our panel of banks. Following a large strand of literature, we define the following minimum-cost frontier and estimate it using the Stochastic Frontier Approach (SFA) of Aigner, Lovell, and Schmidt (1977):[9]

9. The SFA seems to be the preferred methodology for our purpose. Alternative efficiency estimation methods such as the Thick Frontier Approach and the Distribution Free Approach were devised to generate efficiency estimates for groups of banks rather than individual banks. Data Envelopment Analysis is non-stochastic in nature and has been criticized for attributing all deviations from the frontier to technical inefficiency—ignoring the potential for random error.

$$C_{i,t} = f^C(\mathbf{w}_{i,t}, \mathbf{y}_{i,t}, \mathbf{z}_{i,t}) \times \frac{1}{Eff^C_{i,t}} \times e^{v_{i,t}}$$

$$C_{i,t} = f^C(\mathbf{w}_{i,t}, \mathbf{y}_{i,t}, \mathbf{z}_{i,t}) e^{u^C_{i,t}} e^{v^C_{i,t}}$$

$$\ln C_{i,t} = F^C(\mathbf{w}_{i,t}, \mathbf{y}_{i,t}, \mathbf{z}_{i,t}) + u^C_{i,t} + v^C_{i,t}, \tag{1}$$

where $Eff^C_{i,t} = e^{-\hat{u}^C_{i,t}}$, $\hat{u}^C_{i,t} = E(u^C_{i,t} \mid \varepsilon^C_{i,t})$, $\varepsilon^C_{i,t} = (u^C_{i,t} + v^C_{i,t})$ is a composite error term with $u^C_{i,t}$ representing the one-sided inefficiency term that measures the distance to the frontier and $v^C_{i,t}$ the symmetric random error term around the frontier, and **w, y,** and **z** are vectors of factor prices, output levels, and fixed-netput levels, respectively, for bank i in year t. We estimate a single minimum-cost frontier and decompose the composite "error" term ε^C into its inefficiency and random-error components.

To empirically operationalize the analysis we generate a single minimum-cost frontier using the intermediation approach (accounting for both interest and non-interest expenses). We estimate a two-output, three-input, and two-fixed-netput minimum-cost frontier using data on all U.S. commercial banks. Outputs are defined as loans and leases, and securities that are produced using labor, funds provided by transaction deposits and purchased funds, and physical capital and financial (equity) capital. Physical capital and financial capital are included as fixed netputs as these are difficult to change in the short term and are therefore not thought to be sensitive to short-run changes in factor prices. The inclusion of time effects allows for annual shifts in the frontier, but the stable slope coefficients produce the desired uniform benchmark across time. Our resulting cost relationship to be estimated is:[10]

$$\begin{aligned}
\ln\left(\frac{C}{w_3 z_2}\right) = {} & \sum_{t=1984}^{1999} \alpha_t D_t + \sum_{i=1}^{2} \beta_i \ln\left(\frac{w_i}{w_3}\right) \\
& + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \beta_{ij} \ln\left(\frac{w_i}{w_3}\right) \ln\left(\frac{w_j}{w_3}\right) + \sum_{m=1}^{2} \chi_m \ln\left(\frac{y_m}{z_2}\right) \\
& + \frac{1}{2}\sum_{m=1}^{2}\sum_{n=1}^{2} \chi_{mn} \ln\left(\frac{y_m}{z_2}\right) \ln\left(\frac{y_n}{z_2}\right) + \delta_1 \ln\left(\frac{z_1}{z_2}\right) + \frac{1}{2}\delta_{11} \ln\left(\frac{z_1}{z_2}\right)^2 \\
& + \sum_{i=1}^{2}\sum_{j=1}^{2} \gamma_{im} \ln\left(\frac{w_i}{w_3}\right) \ln\left(\frac{y_m}{z_2}\right) + \sum_{i=1}^{2} \mu_i \ln\left(\frac{w_i}{w_3}\right) \ln\left(\frac{z_1}{z_2}\right)
\end{aligned}$$

10. See Berger and Mester (1997) for a discussion of this cost frontier. We scale total costs by one of the input prices to insure factor price homogeneity, and by one of the fixed-netputs to avoid heteroskedastic joint-error terms.

$$+ \sum_{m=1}^{2} \theta_m \ln\left(\frac{y_m}{z_2}\right) \ln\left(\frac{z_1}{z_2}\right) + \sum_{q=1}^{5} [\theta_q \cos(\Psi_q) + \rho_q \sin(\Psi_q)]$$

$$+ \sum_{q=1}^{5} \sum_{r=1}^{5} [\theta_{qr} \cos(\Psi_q + \Psi_r) + \rho_{qr} \sin(\Psi_q + \Psi_r)] + u^C + v^C, \quad (2)$$

where the variables are defined as:[11]

C is the cost of production: interest and non-interest expenses;
D_t are year binary variables equal to 1 for year t, and zero otherwise;
w_1 is the price of labor: salaries and benefits divided by the number of full-time equivalent employees;
w_2 is the price of small (core) deposits: interest expense on all deposits except wholesale certificate of deposits (CDs) divided by the book value of all deposits except wholesale CDs;
w_3 is the price of purchased funds: interest expense on wholesale CDs, fed funds, repos, demand notes issued to the Treasury, other borrowed money, and subordinated notes and debentures divided by the book value of these liabilities;
y_1 is securities: book value of interest bearing balances due from depository institutions, held-to-maturity and available-for-sale securities, fed funds sold, reverse repos, and trading assets;
y_2 is loans and leases: book value of total loans and leases;
z_1 is physical capital: book value of premises and fixed assets;
z_2 is financial capital: book value of equity; and

$\cos(\Psi_q)$ and $\sin(\Psi_q)$ are orthogonal trigonometric Fourier terms that are created based on rescaled cost function explanatory terms spanning the $[0, 2\pi]$ interval.[12] The minimum-cost frontier is estimated using a semi-parametric translog functional form. Previous research has shown that the standard translog function often does not provide an adequate representation of the frontier for all firms in the sample. Most importantly, it has difficulty fitting the relationship for significantly different size institutions, which can be particularly problematic for banks. Fourier transformations have been found to significantly improve the fit using banking data and, therefore, are the approach taken in our analysis (see, e.g., McAllister and McManus 1993, Mitchell and Onvural 1996). All variables measured in levels (e.g., costs, output levels, capital) are indexed to 1999 dollars.

Although a direct estimate of u_i^C for each bank cannot be obtained, as Jondrow et al. (1982) show, an estimate of u_i^C given ε_i^C can be obtained as:

11. Bank and year subscripts i and t are omitted for clarity.

12. Where the cost frontier terms are scaled into the $[0.1 \times 2\pi, 0.9 \times 2\pi]$ range using the following transformation: $\Psi_q = 0.2\pi - \mu \times \text{Min}(\varphi) + \mu \times \varphi$ and $\mu = (0.9 \times 2\pi - 0.1 \times 2\pi)/[\text{Max}(\varphi) - \text{Min}(\varphi)]$. For details, see Berger and Mester (1997).

$$E[u_i^C \mid \varepsilon_i^C] = \frac{\sigma\lambda}{1+\lambda^2}\left[\frac{\phi\left(\frac{\varepsilon_i^C\lambda}{\sigma}\right)}{\Phi\left(\frac{\varepsilon_i^C\lambda}{\sigma}\right)} + \frac{\varepsilon_i^C\lambda}{\sigma}\right], \tag{3}$$

where σ and λ are defined as $\sigma = \sqrt{\sigma_u^2 + \sigma_v^2}$ and $\lambda = \frac{\sigma_u}{\sigma_v}$, and $\phi(.)$and$\Phi(.)$ are the normal and the cumulative normal distributions. Importantly, maximum likelihood estimation (MLE) parameter estimates for σ and λ can be obtained together with the vector of cost-frontier coefficients (see Jondrow et al. 1982, Greene 2000, pp. 394–97). Following Kim and White (1998), the cost frontier is estimated using a three-step procedure. First, we estimate a cost function using ordinary least squares (OLS). The resulting coefficient estimates together with the variance of the predicted OLS error terms are then used as starting values in the MLE where λ is assumed to be equal to 1. The coefficient estimates obtained from this second stage are then used as the starting values for the final MLE of the complete model (including $\hat{\lambda}$ and $\hat{\sigma}$). Efficiency measures are then generated as shown in equation (3).

2.2 Stage 2: Performance Specification

In the second stage of our analysis, we evaluate the effect of increased actual competition resulting from M&As, and increased potential competition resulting from deregulation of entry barriers on bank performance measures. Thus, using data on incumbent, non-merging banks we estimate:

$$\begin{aligned} Perf_{i,t} = a &+ \sum_{j=-2}^{6} b_j MA_{i,t+j} + c_1 Inter\ BHC_{i,t}^{\text{First 3 years}} \\ &+ c_2 Inter\ BHC_{i,t}^{\text{Beyond 3 years}} + c_3 Intra\ BHC_{i,t}^{\text{First 3 years}} \\ &+ c_4 Intra\ BHC_{i,t}^{\text{Beyond 3 years}} + c_5 Intra\ Branch_{i,t}^{\text{First 3 years}} \\ &+ c_6 \text{Intra Branch}_{i,t}^{\text{Beyond 3 years}} + d_1 HHI_{i,t} + d_2 MS_{i,t} \\ &+ d_3 MS_{i,t} \times HHI_{i,t} + e \ln TA_{i,t} + fPCI_{i,t} + D_t + D_i + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where:

$Perf_{i,t}$ is the performance measure;

$MA_{i,t+j}$ equals 1 if entry occurs in bank i's market in year t ($j \in \{-2, -1, \ldots, +6\}$), and 0 otherwise;

$InterBHC_{i,t}$ are binary variables to account for the period after interstate BHC deregulation took place in bank i's state;

$IntraBranch_{i,t}$ are binary variables to account for the period after intrastate branching deregulation took place in bank i's state;

$IntraBHC_{i,t}$ are binary variables to account for the period after intrastate BHC expansion deregulation took place in bank i's state;

$\ln TA_{i,t}$ is the logarithm of bank i's book value of total assets in year t (in 1999 dollars);
$PCI_{i,t}$ is the per capita personal income in the local market (in 1999 dollars);
$HHI_{i,t}$ is the Herfindahl Index for year t for the local market for bank i;
$MS_{i,t}$ is the market share held by bank i at time t;
$HHI_{i,t} \times MS_{i,t}$ is the interaction of the bank's market share and the local market Herfindahl Index;
D_i is the fixed-effect for bank i; and
D_t is the fixed-effect for year t.

In evaluating factors that affect bank performance we account for the influence of actual changes in competition (through M&As), potential changes in competition (from deregulation), market concentration, firm size, fixed bank characteristics, and changes in the industry-wide efficiency. We also incorporate local market characteristics by including per capita personal income and measures of the bank market structure. Both market concentration (*HHI*) and firm market share (*MS*) are added to the specification as is common in studies of the structure–conduct–performance paradigm that regress performance measures on market structure variables (e.g., Smirlock 1985, Berger 1995). Our setup allows us to account for a more complex relationship between efficiency and market structure measures than has been used in the past and may enable us to disentangle the effects of the market power and efficient firm theories by adding the interaction of *HHI* with *MS*. We posit that finding $d_1 = 0$, $d_2 > 0$, and $d_3 \geq 0$ would be consistent with the efficient firm hypothesis whereby more efficient firms are able to increase their market shares (which at the same time may increase market concentration). A finding of $d_1 < 0$, $d_2 = 0$, and $d_3 \leq 0$ would be inconsistent with the efficiency story and would suggest that it is market power that is associated with inefficiency. While this is a relatively stringent test, it does allow for interactions between the structure measures and is consistent with the tests constructed by Smirlock (1985) using alternative performance measures.

A number of points about the second-stage estimation merit some elaboration. First, a 6-year period is used to evaluate efficiency gains following M&A activity in the local market. Thus, our sample excludes banks that are involved in M&As during 6 years that follow the M&A but retains all other banks. While the 6-year time period is somewhat arbitrary, it is based on the observation that empirical research on M&As typically cover 1 to 6 years of post-M&A performance. For example, the post-M&A period examined in a review of 22 published papers (Agrawal and Jaffe 2000, Tables 1 and 2) had an average of 3.4 years (40 months) with a maximum of 5.8 years (70 months). More recent banking studies have stressed the importance of allowing a sufficient time period for effects that take longer to be realized, and they have evaluated even longer time periods–up to 10 years (e.g., DeYoung and Hasan 1998, DeYoung, Hasan, and Kirchhoff 1998, Focarelli and Panetta 2003). For our analysis, it may be that banks make easy changes relatively quickly, but then follow up with more fundamental structural changes. We wanted to allow sufficient time for

efficiency gains to be realized, but not so long after the merger event that there was a high likelihood that the analysis would be capturing alternative influences.

Second, in our second stage, banks in markets where no M&A activity took place provide an industry-wide control: coefficient estimates for the post-M&A binaries capture changes in performance over and above changes in industry performance for the dependent variable. Third, we are also introducing additional flexibility in capturing the effect of deregulation. To allow for the potential for the initial and longer term influence of this deregulation to differ (see DeYoung, Hasan, and Kirchhoff 1998, Focarelli and Panetta 2003), we specify a bifurcated effect: the influence realized over the first 3 years following deregulation and the influence following that period.

Fourth, we are interested in determining whether cost efficiency improves (i.e., $b > 0$) following M&As in the local market. However, it is possible that there is an endogeneity issue: banks in markets where mergers occur may be less efficient and would have been improving whether merger activity had occurred or not. In fact, this may have been one of the factors making the acquisition attractive and certain markets more prone to acquisitions. To allow for this possibility we include indicator variables, MA_{-2} and MA_{-1}, to capture changes in performance in the 2 years prior to the mergers. If performance was not improving prior to the merger, but did so afterward, we have more confidence that the performance improvements were actually associated with the merger.

Fifth, it is clear that our main performance variable, the cost X-efficiency estimate, is measured with error as it is obtained from MLE of our first-stage minimum-cost frontier using the panel of all U.S. commercial banks. This measurement error in the dependent variable, if anything, makes the detection of significant improvements in the relative cost X-efficiency measure more difficult due to the larger standard errors. Econometric theory indicates that in the absence of measurement error in the explanatory variables, the measurement error in the dependent variable will generate larger regression standard errors. However, this does not lead to a bias or loss of consistency (as opposed to the problems created by measurement error in the explanatory variables). In the case of OLS, if the measurement error in the dependent variable is uncorrelated with the explanatory variables of the regression, and if the latter are measured without error, then the Gauss–Markov assumptions still apply and OLS estimators will remain unbiased and consistent, but would be inefficient due to larger standard errors (e.g., see Greene 2000, p. 376, Kmenta 2000, p. 348). A similar case can be easily made for the *within estimator* that we use in the second stage of our analysis, since OLS assumptions also apply to within estimators obtained after subtracting the time-averaged regression equation from the regression equation itself.[13] That is, the methodology that we employ makes it more difficult for us (due to larger standard errors) to find any efficiency gains for incumbent banks.

Finally, the use of the fixed bank- and year-effects estimator in our second stage helps us control for unobservables at the bank or year level as well as potential biases that may follow from using a dependent variable that is estimated in the first stage.

13. See, for example, Cameron and Trivedi (2005, ch. 21).

Our definition of the production process in the first-stage minimum-cost frontier estimation is unlikely to fit all commercial banks with the same degree of success, potentially creating a bias in cost X-efficiency estimates for some banks. It may also be that changes in bank production technology might lead to differences in the fit of the first-stage frontier across years.[14] Fixed-effects regression will help account for these influences and allows us to focus on changes in X-efficiency on incumbent banks.

2.3 Data

To implement our two-stage process of relating bank performance to M&A activity we combine bank and banking market data from a number of sources. Since we use balance sheet and income statement information that banks are required to report to regulatory authorities, we are able to obtain data on the entire population of U.S. commercial banks.[15] Bank-level financial data are obtained from the year-end Report of Condition and Report of Income Statements (Call Reports). M&A information is from the Federal Reserve Board of Governors' Merger and Acquisition database. Summaries of deposit data from the FDIC are used to measure market share and concentration. We generate the bank-level cost X-efficiency measure from a single minimum-cost frontier estimate based on *all* commercial banks in existence in the United States after deleting banks with zero or negative (i) total assets, (ii) equity capital, (iii) deposits or loans, as well as banks for which market definitions were inconsistent over time. We develop an unbalanced panel data set with over 120,000 *incumbent* bank observations covering 1984–99. All acquirers and their targets are dropped from the database for 6 years starting with the year of the acquisition (below we provide some summary statistics on these institutions). We also exclude from our sample "roll-ups," i.e., mergers involving banks within the same bank holding company (BHC). This allows us to focus on incumbent banks in the acquisition-affected market using the banks in the non-M&A markets as a control group. However, even though we can observe M&As and deregulation at the market level, we can only create bank-level performance measures, not bank- *and* market-level performance measures. As a result, as is typical in bank X-efficiency studies, we are constrained to associate each bank with its largest market (e.g., see Berger and Mester 1997, 2003). Summary statistics of the M&A data and our sample are presented in Tables 1–4.

Concerning our deregulation information, we define intrastate branching deregulation (*IntraBranch*) as occurring when a state moves from unit or some form of limited statewide branching to unlimited statewide branching. In 1986 (the starting year of our sample because of the 2-year lag required for MA_{-2}) all states except Illinois,

14. Our flexible form semi-parametric minimum-cost frontier allows for shifts in cost levels (intercept) across the years. However, depending on industry dynamics, the distribution of X-efficiency estimates, although based on a single distribution of coefficient estimates, may still show some annual variation.

15. Again, limited data are available to analyze alternative performance measures using U.S. data. Bank prices are either imputed from balance sheet data or are based on surveys of limited scope, and relatively few banks are publicly owned and actively traded.

TABLE 4

DESCRIPTIVE STATISTICS

	Mean	Std. dev.	Median	Max.	Min.	Obs.
Cost X-efficiency	85.59%	7.69%	87.48%	98.77%	15.24%	121,291
Total costs/TA	7.48%	1.53%	7.41%	11.94%	4.55%	121,291
Non-interest expenses/TA	3.09%	0.95%	2.93%	6.69%	1.43%	121,291
Labor expenses/TA	156.23%	46.29%	150.09%	472.91%	43.12%	121,291
Fixed asset expenses/TA	1.59%	1.07%	1.36%	5.39%	0.11%	121,291
Interest expenses/TA	4.39%	1.32%	4.44%	7.50%	1.87%	121,291
Transaction deposits/TA	25.04%	7.43%	24.10%	47.87%	10.82%	121,291
Non-transaction deposits/TA	63.13%	8.02%	63.98%	78.73%	38.94%	121,291
InterBHC	0.76	0.43	1	1	0	121,291
IntraBHC	0.43	0.50	0	1	0	121,291
IntraBranch	0.38	0.49	0	1	0	121,291
TA (millions of 1999 dollars)	97.73	258.12	53.27	18,939.00	2.00	121,291
PCI (thousands of 1999 dollars)	20.1081	3.9357	19.7739	54.0275	6.1334	121,291
HHI	0.0733	0.1397	0.0310	1.0000	0.0002	121,291
MS	0.1929	0.2066	0.1215	1.0000	0.0001	121,291

NOTES: Cost X-efficiency figures are estimates from a cross-sectional translog cost function augmented with Fourier semi-parametric terms assuming a half-normal–normal composite error term. *InterBHC*, *IntraBHC*, and *IntraBranch* are indicator variables to account for interstate BHC, intrastate BHC and intrastate branching deregulation, respectively. *TA* is the bank's total assets in millions of 1999 dollars, *HHI* (Herfindahl–Hirshman Index) and *MS* are the concentration and market share for the bank's most important market based on deposits, *PCI* is per capita personal income measured in 1999 dollars. Financial ratios are truncated at the 1% and 99% levels of their distributions to avoid the excessive influence of outliers.

Kansas, North Dakota, and Texas allowed some form of statewide branching. We define intrastate BHC (*IntraBHC*) deregulation as passage from limited to unrestricted operations for BHCs within the state. Interstate BHC deregulation (*InterBHC*) occurs when legislation allows out-of-state BHC entry based on regional reciprocal, national reciprocal, or national non-reciprocal agreements (whichever comes first). For each form of deregulation, we estimate the model assuming a specification that allows for a bifurcated response to the change: an initial shift followed by a second, more permanent effect. Thus, for each form of deregulation, we have a binary variable that is set equal to 1 for the first 3 years starting with the year in which the deregulation occurred, 0 otherwise ($IntraBranch^{\text{First3Years}}$, $IntraBHC^{\text{First3Years}}$, and $InterBHC^{\text{First3Years}}$), and another binary that is set equal to 1 after this initial 3-year period, 0 otherwise ($IntraBranch^{\text{Beyond3Years}}$, $IntraBHC^{\text{Beyond3Years}}$, and $InterBHC^{\text{Beyond3Years}}$). The sources of information for deregulation include Amel (2000) and Berger, Kashyap, and Scalise (1995, Table B6). Table 4 presents the descriptive statistics for the variables used in the second-stage regression.

Although our major objective is to analyze the effect of M&As on the performance of incumbents, we also examined the cost X-efficiency performance of more than 2,100 acquirers and their targets. We find that in the year prior to the M&A, the acquirers were more efficient than the targets: the acquirers' average cost X-efficiency was 85.31% whereas the average for the targets was 82.34%.[16] The average cost X-efficiency of banks in our sample (non-acquired incumbents and banks in markets with

16. The difference is statistically significant at the 1% level.

no M&As) is 85.59%. Thus, unlike target banks, acquirers appear to be no different than the population of banks that were not involved in M&As. To get an indication of the acquirer's ability to improve efficiency, we also compare the merging institutions' total assets-weighted pro-forma cost X-efficiency in the year prior to the M&A with that of the surviving institution in the year following the M&A. The pro-forma cost X-efficiency for the combining banks was 84.78% in the year prior to the M&A. In the year following the M&A, the surviving institution's cost X-efficiency was 85.19%, indicating that the acquiring banks were able to improve the performance of the banks they acquired.[17]

3. EMPIRICAL RESULTS

We are interested in determining whether incumbent banks' efficiency improves (i.e., $b > 0$) following M&As in the local market. However, as explained earlier, it is possible that the efficiency of banks in markets where mergers occurred may have been improving whether entry had occurred or not, thus potentially creating an endogeneity problem for our second-stage estimation. If efficiency was improving prior to the M&A, it is more difficult to attribute the post-merger efficiency gains to the acquisition. To allow for this possibility, we capture changes in performance both before and after the mergers, after controlling for bank and market characteristics and accounting for deregulation.

The results using the levels of cost X-efficiency as the performance measure for the full sample are presented in column 1 of Table 5. They do not indicate any efficiency improvement prior to entry as the coefficient estimates for MA_{-2} and MA_{-1} are not statistically different from zero. This general lack of pre-merger efficiency gains adds support to our contention that the post-merger gains are related to the merger event. Indeed, we do see efficiency improvements after M&As. These findings are consistent with our earlier discussion of banks attempting to improve their efficiency when they are confronted with increased competition via a structural change in the local market. For the year of the merger and the next 6 years following a merger in the local market, the positive coefficients suggest that the cost X-efficiency of incumbent banks improves relative to banks in markets without entry, with more significant improvements coming in the latter years.[18] This improvement occurs even after controlling for market and bank specific characteristics, including unobservable bank-specific

17. The difference is statistically significant at the 1% level. Our finding that acquirers are more efficient than targets is common in the banking literature. This implies that potential merger-related efficiency gains exist. However, the existing evidence on the *post-merger* cost X-efficiency performance for the merging parties remains inconclusive. Shaffer (1993) simulates X-efficiency changes and finds that M&As could potentially improve cost X-efficiencies. Berger and Humphrey (1992) find a small but statistically insignificant improvement in cost X-efficiency for large U.S. bank mergers. In contrast, Peristiani (1997) finds that cost X-efficiency levels and rankings worsen for the merged institutions over the 3 years following the M&A.

18. Six of the seven coefficients are significant at the 10% level or better.

TABLE 5

BANK PERFORMANCE MODELS USING RELATIVE COST X-EFFICIENCY ESTIMATES

	(1) Whole sample	(2) Out-of-market M&As	(3) Less competitive markets quartile	(4) High-impact M&As (>10% market acquired)	(5) Less competitive & out of market	(6) Less competitive & high impact
MA_{-2}	0.0316	0.0091	0.0882	−0.0083	0.0868	0.0536
	(0.46)	(0.13)	(0.55)	(0.12)	(0.54)	(0.33)
MA_{-1}	−0.1101	−0.1151	−0.1249	−0.1123	−0.1243	−0.1470
	(1.60)	(1.62)	(0.68)	(1.59)	(0.67)	(0.80)
MA_{0}	0.0947*	0.0883	0.2842*	0.0425	0.2113	0.2365
	(1.67)	(1.26)	(1.89)	(0.62)	(1.23)	(1.46)
MA_{+1}	0.1047*	0.1315**	0.2655*	0.1071*	0.2655	0.2553
	(1.70)	(2.07)	(1.67)	(1.67)	(1.64)	(1.60)
MA_{+2}	0.1219*	0.1589**	0.5465***	0.1297*	0.5444***	0.5071***
	(1.75)	(2.25)	(3.30)	(1.81)	(3.26)	(3.02)
MA_{+3}	0.1730**	0.2050***	0.4401**	0.1877**	0.4343**	0.4288**
	(2.21)	(2.59)	(2.39)	(2.31)	(2.36)	(2.31)
MA_{+4}	0.2218**	0.2344**	0.4580**	0.1902**	0.4572**	0.4004**
	(2.45)	(2.57)	(2.36)	(2.03)	(2.35)	(2.03)
MA_{+5}	0.1172	0.1132	0.5253**	0.0723	0.5182**	0.4654**
	(1.10)	(1.05)	(2.36)	(0.66)	(2.34)	(2.09)
MA_{+6}	0.2590**	0.2650**	0.8292***	0.2514**	0.8106***	0.8062***
	(2.10)###	(2.14)###	(3.41)###	(1.98)###	(3.35)###	(3.29)###
$InterBHC^{\text{First 3 Years}}$	0.2279***	0.2289***	−0.0549	0.2088***	−0.0608	−0.0668
	(4.68)	(4.43)	(0.64)	(4.02)	(0.71)	(0.78)
$InterBHC^{\text{Beyond 3 Years}}$	0.2418***	0.2173***	−0.0825	0.1491**	−0.0785	−0.0892
	(3.40)	(2.88)	(0.66)	(1.96)	(0.62)	(0.70)
$IntraBHC^{\text{First 3 Years}}$	−0.1718*	−0.0623	−0.2975	−0.1094	−0.3503	−0.3444
	(1.84)	(0.56)	(0.96)	(1.01)	(1.13)	(1.11)
$IntraBHC^{\text{Beyond3Years}}$	0.3150***	0.4086***	0.6217*	0.4048***	0.6214*	0.6220*
	(3.06)	(3.55)	(1.93)	(3.52)	(1.93)	(1.93)

TABLE 5

CONTINUED

	(1) Whole sample	(2) Out-of-market M&As	(3) Less competitive markets quartile	(4) High-impact M&As (>10% market acquired)	(5) Less competitive & out-of-market	(6) Less competitive & high-impact
$IntraBranch^{\text{First 3 Years}}$	−0.7614***	−0.7634***	−0.8173***	−0.7608***	−0.8246***	−0.8230***
	(14.78)	(13.83)	(7.95)	(13.65)	(7.98)	(7.93)
$IntraBranch^{\text{Beyond 3 Years}}$	−1.6532***	−1.6807***	−1.8922***	−1.6990***	−1.8827***	−1.8960***
	(26.16)	(25.02)	(15.16)	(24.85)	(14.97)	(15.04)
ln*TA*	6.6357***	6.4690***	6.6380***	6.5111***	6.6294***	6.5973***
	(58.23)	(52.20)	(28.83)	(54.40)	(28.56)	(28.41)
PCI	0.1089***	0.0879***	0.0619**	0.0920***	0.0619**	0.0587*
	(6.18)	(4.62)	(2.03)	(4.77)	(2.02)	(1.91)
HHI	−1.3860	−1.5714	−1.4190	−1.8570*	−1.5588	−1.4872
	(1.27)	(1.42)	(1.18)	(1.71)	(1.28)	(1.23)
MS	−0.5011	−0.0449	0.7974	−0.6514	0.7222	0.7628
	(0.87)	(0.07)	(0.93)	(1.06)	(0.84)	(0.88)
HHI × *MS*	3.0947**	2.8597**	1.3846	3.6610***	1.4708	1.4611
	(2.35)	(2.13)	(0.96)	(2.79)	(1.01)	(1.01)
*HHI**	1.7087**	1.2883*	−0.0344	1.8039**	−0.0880	−0.0261
	(2.34)	(1.72	(0.05)	(2.40)	(0.12))	(0.04)
*MS**	2.5936**	2.8148**	2.1820*	3.0095***	2.1930*	2.2239*
	(2.21)	(2.37	(1.81)	(2.56)	(1.80)	(1.84)
Number of observations	121,291	104,143	31,155	102,732	30,868	30,793
Number of banks	11,741	11,362	3,267	11,421	3,254	3,262
R^2	0.1335	0.1381	0.1536	0.1395	0.1534	0.1530
Model's *F*-stat	313.70***	281.80***	97.94***	278.91***	96.91***	96.27***

NOTES: The table presents estimates of model (4) where the dependent variable is relative cost X-efficiency (in %). MA_{t+j} is a binary variable equal to 1 in year *j* if a M&A takes place in year *t* in bank *i*'s market ($j \in \{-2,-1, 0, +1, \ldots,+6\}$), and 0 otherwise. *InterBHC, IntraBHC,* and *IntraBranch* are indicator variables measuring the impact of interstate BHC, intrastate BHC, and intrastate branching deregulations, respectively. ln*TA* is the log of bank's total assets in millions of 1999 dollars. *HHI* (Herfindahl–Hirshman Index) and *MS* are the concentration and market share for the bank's most important market based on deposits. Personal income per capita *(PCI)* is measured in 1999 dollars. *t*-statistics are presented below the coefficient estimates, and ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. ###, ##, and # denote 1%, 5%, and 10% significance for the test that MA+ coefficients are jointly equal to zero. The time fixed-effect coefficient estimates are excluded to conserve space.

characteristics through bank-fixed effects that may explain efficiency. Thus, we do see efficiency gains, although the magnitude of the response is somewhat limited—approximately 10 to 15 basis points per year for the first 2 years and 20 basis points for the remaining years following the merger. While at first glance this improvement may appear to be rather small, the societal effects may be quite significant since M&As affect all incumbents and not just the merging parties.

However, we would expect the incumbent banks' response to differ across markets under certain conditions, conditions that we have not necessarily accounted for in the empirical analysis. To test for differential effects across markets we analyze select subsamples where, *ex ante*, mergers may be expected to be more influential in inducing a response by incumbent banks. Column 2 of Table 5 presents evidence of efficiency improvements following mergers that bring a new bank to the local market, i.e., mergers that have a non-local bank enter the market. The somewhat larger and more significant coefficients suggest that the response of incumbent banks in these markets is stronger than in the average market where a merger occurs. Compared to column 1 the coefficient estimate for MA_{+1} goes from approximately 10 to 13 basis points, for MA_{+2} from 12 to almost 16 basis points, and for MA_{+3} from 17 to 21 basis points. We see marginally larger increases in efficiency for years 3 through 6. Apparently, incumbent banks feel compelled to respond to the new market competitor and do so by improving operational efficiency.

One might also expect the response to be greater in markets where the potential for efficiency improvements is greatest. This could occur in markets where the incumbents have previously been protected from competition and, thus, protected from the need to be efficient. That is, one would expect the least efficient firms to be in protected markets. To evaluate this potential, we consider merger activity in heavily concentrated markets (defined as the least competitive quartile of banks based on market HHI). When we evaluate this subsample of markets (column 3 of Table 5) we do indeed see more significant improvements in efficiency following the M&A activity. The incumbents respond relatively swiftly and significantly. In fact, it is in these markets where we find the most significant responses (largest coefficients) beginning in the year of the merger. The coefficient estimates for MA_j indicate an increase in cost X-efficiency of 28 basis points in the year of the merger, an increase of 27 basis points in the next year, followed by statistically significant increases of 55, 44, 46, 52, and 83 basis points in years 2 through 6 following the M&A. We suspect that the larger efficiency gains are due to the initial relative inefficiency of banks in the most concentrated markets, compared to banks in non-protected markets, and the resulting room to improve that efficiency when challenged by an M&A in the local market. It is likely that easier adjustments are made initially, followed by more fundamental structural changes over time.

One may also expect the response of incumbents to a merger to be greater when it has a significant impact on the structure of the market place, i.e., when there is a "high-impact" M&A. To test this, we consider a merger to be high impact if it results in 10% or more of the market deposits being acquired and separately analyze activity

in these markets in column 4 of Table 5.[19] Somewhat surprisingly, we find that while there is indeed a significant improvement in X-efficiency following the merger, the response is very similar to that found in all markets when mergers occur. Thus, the size of the merger seems not to be particularly important in inducing a response. One possibility for this finding is that any merger, regardless of size appears to "awaken" incumbent banks and encourage them to implement operational improvements.

To get an indication of what is driving the results, the last two columns of Table 5 show the extent of cost X-efficiency improvements of incumbents in combinations of submarkets in which there is a reason to expect the responses of incumbents to be greater than in the typical market. We combine mergers in less competitive markets with mergers involving non-local entry (column 5) and mergers in less competitive markets with high-impact mergers (column 6). Again, the magnitude and significance of the response to mergers in these cases tends to be greater than that found in column 1 (the overall sample), and corresponds more closely to the results found in column 3. Thus, whether we have high-impact mergers in concentrated markets or mergers involving non-local entry in concentrated markets, the results are essentially the same. The larger efficiency gains result from the initial relative inefficiency of banks in these concentrated markets, compared to banks in non-protected markets, and the resulting room to improve that efficiency when challenged by an M&A in the local market.

In addition to the cost efficiency response of incumbent banks to actual entry via M&As, we are interested in the response to the elimination of potential entry barriers. Since the barriers come in separate forms (restrictions on intrastate branching, intrastate holding company expansion, and interstate holding company expansion) we account for each separately (the c_i coefficients). As stated earlier, we allow the deregulatory impact to differ through time. We assume that the initial response to the deregulation may differ from the longer run, permanent response. Thus, we have two binary variables associated with each form of deregulation: one accounting for the impact for the first 3 years following deregulation and another for the "permanent" effect following the initial 3-year period.

The results are somewhat mixed for the influence of eliminating entry barriers. Concentrating on column 1 of Table 5 (the entire sample), the elimination of barriers to across-state BHC expansion (*InterBHC*) results in banks significantly improving cost X-efficiency. The coefficient estimates indicate a 23-basis-point improvement in cost X-efficiency for interstate-BHC deregulation during the first 3 years, and 24-basis-point increase in the remaining years. This suggests that the increase in potential competition resulting from the opening up of banking markets to banks from other states put competitive pressure on banks in the deregulated markets and resulted in significant cost X-efficiency improvements.

The effect of eliminating within-state barriers to BHC expansion (*IntraBHC*) is somewhat different. For most of the subsamples, the coefficient estimate for the

19. The 10% figure aligns well with current antitrust practices. Regulators often use this threshold to initiate a different level of scrutiny to a merger.

3 years immediately following the lifting of the restrictions is statistically insignificant, with results in column 1 showing a perverse negative effect. This may indicate an initial adjustment period during which few efficiency gains are realized as a result of the elimination of within-state BHC expansion rules. The deregulation does have a significant effect after this initial period, which more than offsets any initial adverse effects. This efficiency improvement is greatest in protected markets (column 3). This absence of an immediate response following interstate BHC expansion, followed by future improvements is somewhat consistent with DeYoung, Hasan, and Kirchhoff (1988) who found efficiency actually *deteriorated* with market entry immediately following the elimination of entry barriers, but eventually (after 6 years) delivered gains in efficiency. However, the two studies are not directly comparable as DeYoung, Hasan, and Kirchhoff (1998) examine a single cross-section, 1992, and focuses on MSA markets, whereas our sample is a panel of 15 years covering both urban and rural markets.

Efficiency gains were not found to be realized by banks when statewide branching laws were relaxed (*IntraBranch*); in fact, the regulatory change was associated with a deterioration in cost X-efficiency ($c_5 < 0$ and $c_6 < 0$). This is not in line with our expectation that all forms of deregulation would result in increased competition and increased market pressure to improve efficiency. However, there are a couple of potential reasons for this finding. Banks may have expanded their branching networks and increased their costs following the elimination of restrictions on this type of activity, resulting in higher operating costs relative to those in other states that did not change their branching network. Alternatively, with the reductions in branching restrictions, banks may have restructured their organizations and turned "more independent" holding company member banks into "less independent" branch facilities. There is evidence that significant restructuring through this "roll-up" process did occur following deregulation (see Rice 2001, Table 9). Others have also found this deterioration in performance in markets following the elimination of branching restrictions (see, e.g., Hannan and Prager 1998). Additionally, Evanoff (1988) found evidence suggesting that strategic behavior by banks following deregulation could produce unexpected responses to branching deregulation.[20]

Concerning the other control variables in the cost efficiency analysis, the results suggest that larger banks are more cost X-efficient, as are banks located in markets with higher per capita income. The influence of market concentration and market share of the individual bank is captured by the coefficient estimates for *HHI*, *MS*, and their interaction. We earlier argued that a finding of $d_1 = 0$, $d_2 > 0$, and $d_3 \geq 0$ would be consistent with larger firms gaining market share as a result of being more

20. Evanoff (1988) found that banking office accessibility was greater in markets allowing only limited branching than in markets allowing unlimited branching. The difference was attributed to strategic behavior by banks in limited-branching markets in an attempt to decrease the viability of entry by rivals. In these markets, elimination of expansion barriers could well result in what would appear to be a perverse decrease in service levels as branches originally introduced to deter entry in the limited branching environment may be closed when broader expansion was allowed. Thus, strategic behavior by banks could produce unexpected responses to deregulation.

efficient, and a finding of $d_1 < 0$, $d_2 = 0$, and $d_3 \leq 0$ would suggest that it is market power that is creating an environment in which all firms in the market are shielded from competition and, therefore, less efficient. For the entire sample, the tests appear to be too stringent and neither structure measure is found to significantly influence bank efficiency (i.e., we find $d_1 = 0$ and $d_2 = 0$). However, the sign on the interaction term (d_3) is positive and significant, which would only be consistent with the efficient firm hypotheses. Similarly, the derivatives of the efficiency equation with respect to HHI and MS are both positive (reported as HHI* and MS* at the bottom of Table 5), which would only be consistent with the efficient firm hypotheses. However, neither of the competing hypotheses is supported based on the more stringent test discussed earlier, making it difficult to draw meaningful conclusions concerning the viability of the efficiency hypotheses versus the structure–conduct–performance hypotheses.

To summarize, the findings are generally consistent with welfare-enhancing effects from entry via M&As and, with some exceptions, from potential entry following the elimination of entry barriers. Additionally, the extent of the improvement was greatest in markets where the potential for change was greatest—in highly concentrated markets. We also found significantly more response by incumbents when the merger resulted in a new competitor in the market—i.e., a non-local acquirer.[21]

As a means to get an indication of the potential source of the cost efficiency gains, we also analyze the impact of potential and actual entry on bank performance measured with more standard cost accounting ratios. We relate various cost ratios to the same measures of entry barrier reductions and mergers as before. The results found using the entire sample are presented in Table 6. However, these results should be treated with caution as, in contrast to X-efficiency estimates obtained from minimum cost frontiers, accounting ratios presume that all other influences (input prices, output, and fixed-netputs levels) remain constant across banks, when this is clearly not a credible assumption.

We find (in column 1) that total costs relative to total assets decline in the years following mergers, consistent with the cost-frontier analysis and indicating that banks were attempting to respond to the new environment. However, declines were already occurring prior to the merger, making it less obvious that the improvements should be attributed to the merger. In fact, based on these results, the improving cost ratios of banks in markets with mergers may have been what initially made the acquisition attractive. The cost reductions that occur following the merger come from savings in both interest and non-interest expenses. The changes in interest expenses (column 2), while significant in a statistical sense and occur both before and after the M&A, are relatively small and most of the decreases occur in the early years following the acquisition. This is consistent with a depositor run-off story where incumbent banks

21. We also generated estimates of profit X-efficiency (see Berger 1995). However, as discussed earlier, the impact of M&As on the profit efficiency of incumbents is less obvious because of the potential for the "mixing" of revenue and cost responses. Indeed, a parallel analysis of profit efficiency, which is available from the authors on request, showed less significant and less consistent efficiency gains. Given that we do find evidence of cost efficiency improvement following the mergers, the lack of improvements in profit efficiency is thought to be associated with the previously mentioned revenue effects.

TABLE 6

BANK PERFORMANCE MODELS USING ALTERNATIVE ACCOUNTING RATIOS

	(1) Total costs *TA*	(2) Interest expenses *TA*	(3) Non-interest expenses *TA*	(4) Labor costs *TA*	(5) Fixed asset costs *TA*	(6) Trans-action deposits *TA*	(7) Non-trans. deposits *TA*
MA_{-2}	−0.0316***	−0.0197***	−0.0091	0.1426	−0.1400	−0.0191	−0.0003
	(3.07)	(3.14)	(1.23)	(0.39)	(0.72)	(0.34)	(0.00)
MA_{-1}	−0.0512***	−0.0382***	−0.0119*	0.0836	−0.1641	0.0159	0.0091
	(5.36)	(6.44)	(1.72)	(0.24)	(0.90)	(0.29)	(0.15)
MA_{0}	−0.0456***	−0.0326***	−0.0178***	−0.6632**	−0.4847***	0.0743*	0.0752
	(5.78)	(6.84)	(3.05)	(2.22)	(3.30)	(1.66)	(1.45)
MA_{+1}	−0.0507***	−0.0348***	−0.0193***	−0.4533	−0.6376***	0.1000**	0.0298
	(5.96)	(6.84)	(3.06)	(1.37)	(4.03)	(2.03)	(0.52)
MA_{+2}	−0.0295***	−0.0184***	−0.0116*	−0.3625	−0.4823***	0.0831	0.0122
	(3.13)	(3.24)	(1.65)	(1.01)	(2.76)	(1.50)	(0.19)
MA_{+3}	−0.0382***	−0.0135**	−0.0220***	−0.5144	−0.5147***	0.0137	0.0203
	(3.73)	(2.16)	(2.85)	(1.28)	(2.64)	(0.22)	(0.28)
MA_{+4}	−0.0334***	−0.0029	−0.0270***	−0.9449**	−0.5566**	−0.0690	0.1395*
	(2.92)	(0.41)	(3.10)	(2.12)	(2.56)	(0.93)	(1.66)
MA_{+5}	−0.0304**	−0.0037	−0.0281***	−0.9457*	−0.4059*	−0.0499	0.2219**
	(2.30)	(0.45)	(2.79)	(1.80)	(1.65)	(0.61)	(2.32)
MA_{+6}	−0.0357**	−0.0038	−0.0323***	−1.3880**	−0.3933	−0.0206	0.1096
	(2.36)###	(0.42)###	(2.83)###	(2.42)###	(1.40)###	(0.21)	(0.99)#
$InterBHC^{\text{First 3 Years}}$	0.0211***	0.0379***	−0.0238***	−1.0746***	0.1622	−0.1634***	0.3005***
	(2.84)	(8.21)	(4.56)	(4.13)	(1.18)	(4.06)	(6.55)
$InterBHC^{\text{Beyond 3 Years}}$	0.0949***	0.0967***	−0.0124*	−1.0636***	0.7582***	−0.3623***	0.7792***
	(8.95)	(14.82)	(1.65)	(2.82)	(3.96)	(6.29)	(11.65)
$IntraBHC^{\text{First 3 Years}}$	−0.0191	−0.0211**	0.0122	2.6550***	−0.4201	0.2043**	−0.5160***
	(1.34)	(2.22)	(1.19)	(5.07)	(1.41)	(2.55)	(5.38)

TABLE 6

CONTINUED

	(1) Total costs *TA*	(2) Interest expenses *TA*	(3) Non-interest expenses *TA*	(4) Labor costs *TA*	(5) Fixed asset costs *TA*	(6) Trans-action deposits *TA*	(7) Non-trans. deposits *TA*
$IntraBHC^{\text{Beyond 3 Years}}$	−0.0379***	−0.0032	−0.0272***	−1.5053***	−0.7990***	−0.6639***	0.2093**
	(2.64)	(0.33)	(2.60)	(2.80)	(2.78)	(7.94)	(2.05)
$IntraBranch^{\text{First 3 Years}}$	0.0610***	−0.0211***	0.0812***	0.6994***	0.9214***	0.0392	−0.0880*
	(7.67)	(4.33)	(14.37)	(2.58)	(6.59)	(0.93)	(1.83)
$IntraBranch^{\text{Beyond 3 Years}}$	−0.0025	−0.1165***	0.1134***	2.9480***	1.1155***	0.8391***	−0.8519***
	(0.29)	(22.05)	(17.80)	(8.99)	(6.83)	(16.13)	(14.42)
ln*TA*	−0.4790***	0.3280***	−0.8113***	−37.2563***	−11.4180***	−4.7956***	4.3662***
	(29.04)	(34.25)	(64.35)	(59.73)	(39.63)	(50.14)	(41.68)
PCI	0.0009	−0.0032**	0.0049***	0.3888***	0.0226	0.1604***	−0.1872***
	(0.44)	(2.55)	(3.13)	(5.06)	(0.60)	(13.39)	(14.16)
HHI	−0.2398	−0.4050***	0.2302**	23.3445***	3.2416	7.2892***	−5.1278***
	(1.64)	(3.81)	(2.15)	(4.09)	(1.23)	(6.65)	(4.64)
MS	1.1484***	0.8448***	0.3470***	12.6810***	3.2790***	0.7385∗	3.0688***
	(14.24)	(17.10)	(6.22)	(4.99)	(2.72)	(1.77)	(6.50)
HHI × *MS*	−0.4318***	−0.0846	−0.4226***	−25.5721***	−8.5776***	−6.7388***	2.7111**
	(2.73)	(0.76)	(3.61)	(4.21)	(3.06)	(5.73)	(2.29)
*HHI**	−0.6717***	−0.4896***	−0.1924***	−2.2275	5.3360***	0.5504	−2.4166***
	(9.44)	(12.44)	(3.63)	(0.97)	(4.73)	(1.36)	(5.35)
*MS**	0.7165***	0.7602***	−0.0756	−12.8911**	−5.2986**	−6.0002***	5.7800***
	(4.66)	(6.84)	(0.69)	(2.26)	(2.01)	(5.27)	(5.10)
Number of observations	121,291	121,291	121,291	121,291	121,291	121,291	121,291
Number of banks	11,741	11,741	11,741	11,741	11,741	11,741	11,741
R^2	0.7721	0.9072	0.1346	0.1114	0.0507	0.1669	0.2335
Model's *F*-stat	9903.18***	28622.74***	226.37***	202.24***	86.42***	537.58***	890.09***

NOTES: The table includes estimates of model (4) where the dependent variables are various cost ratios (in %). MA_{t+j} is a binary variable equal to 1 in year *j* if a M&A takes place in year t in bank *i's* market ($j \in \{-2,-1, 0, +1, \ldots,+6\}$), and 0 otherwise. *InterBHC*, *IntraBHC*, and *IntraBranch* are indicator variables measuring the impact of interstate BHC, intrastate BHC and intrastate branching deregulations, respectively. ln*TA* is the log of bank's total assets in millions of 1999 dollars. *HHI* (Herfindahl–Hirshman Index) and *MS* are the concentration and market share values for the bank's most important market based on deposits. Personal income per capita (*PCI*) is measured in 1999 dollars. *t*-statistics are presented below the coefficient estimates, and ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively. ###, ##, and # denote 1%, 5%, and 10% significance for the test that MA+ coefficients are jointly equal to zero. The time fixed-effect coefficient estimates are excluded to conserve space.

find the cost of raising funds in the local market to suddenly decline as customers move deposits from the newly acquired institution. The results presented in columns 6 and 7 lend additional support to this explanation. In the initial year of the merger and the following year, the ratio of transaction deposits to assets increases for incumbent banks, while the interest expense ratio actually declines (column 2). Thus, these additional deposits seem to be a relatively inexpensive source of funding in the years immediately following the merger. We do not see a similar effect with the less liquid non-transaction deposits, which may be more difficult to quickly move from the acquired bank. Not surprisingly, the deposit run-off is a temporary phenomenon and in the years further removed from the merger we see the increase in the transaction deposits and the decrease in interest expenses going away.

Management should, however, have more direct control over non-interest expenses. For example, it is common around M&As to read in the popular press that bank management intends to respond to the increased competition by improving back-room operations, eliminating certain facilities and decreasing labor costs. The results presented in column 3 suggest that the non-interest expense ratio did indeed decline following the mergers, with the decline becoming more pronounced in the later years following the M&A. This is consistent with organizational changes taking time to implement before reaping the full benefits of the adjustments. Both labor expenses (column 4) and expenses for plant and equipment (column 5) declined following the merger, although the decline in labor expenses is not statistically significant across all years.

3.1 Robustness Checks

To test the robustness of our results, we re-estimated the performance regression using alternative samples and specifications. We restricted our sample to banks that obtain at least 50% (and alternatively, 75%) of their deposits from their main market. We tested for different adjustment periods (4 and 5 years for j in MA_j). We re-estimated the second stage without the market share variable.[22] We used cost X-efficiency estimates obtained from *separate* cost frontiers for individual years instead of a single cost frontier over the whole panel. None of these adjustments resulted in significant changes in our major findings.[23]

22. This was done to address an endogeneity concern. The efficiency hypothesis in the market structure literature suggests that efficient firms will gain market share over time as a result of their operational superiority. Thus, there could be a feedback between the dependent and independent variables. None of our conclusions were appreciably altered when *MS* was dropped from the analysis.

23. At the request of an anonymous referee, we also took a more general approach and analyzed the correlations between the cost X-efficiency and the explanatory variables used in the performance regression. We calculated Spearman rank-order correlations with relative cost X-efficiency estimates that were de-meaned on an annual basis to account for any secular trend in the efficiency estimate through time. We found the correlations to be in line with our results presented in Table 5 for years MA_{+3} through MA_{+6} but inconsistent with the results for years MA_{-2}, and MA_0 through MA_{+2}. We believe that the observed discrepancy is due to (i) the univariate nature of Spearman rank order correlations which do not control for other possible explanatory factors (such as deregulation and market structure) and (ii) the unobservable factors that our second-stage fixed bank-effects regression controls for. The results are available from the authors upon request.

Finally, to check the robustness of our results to the cost efficiency estimation assumptions, we re-estimated the performance model using cost X-efficiency *rankings* instead of efficiency levels. Under the SFA, one could obtain different estimates of inefficiency depending on the underlying assumptions concerning the distribution of the X-efficiency component of the composite error term (whether it is distributed half-normal, truncated-normal, exponential, etc.). While X-efficiency levels will differ, their *rankings* would always be the same irrespective of the distributional assumption made under the SFA (see Bauer et al. 1998).[24] The findings from the alternative specification with X-efficiency rankings generally corroborate our findings based on efficiency levels.[25] We conclude that our findings are robust.

4. SUMMARY AND CONCLUSIONS

Much of the recent banking literature has evaluated the impact of bank mergers on the efficiency of the merging parties. The evidence suggests that while acquiring banks are typically more efficient than acquired banks, creating the potential for the new combined organization to be more efficient, these potential gains appear to often not be realized. This has led some to question the motives driving the merger decision and question the benefits resulting from the recent increase in bank merger activity. However, in addition to any efficiency gains realized by the parties *involved* in a bank merger, economic theory argues that additional gains should result from the impact of the merger on the degree of local market competition. We therefore take a somewhat more comprehensive approach and evaluate the impact of actual and potential competition resulting from bank mergers and reductions in entry barriers on the productive efficiency of *incumbent* (non-merging) banks in the affected banking market.

Our findings are consistent with economic theory: as competition increases as a result of market entry or the creation of a more viable local competitor, the incumbent banks respond by decreasing costs and increasing their level of cost efficiency. The efficiency gains are greater in markets where the acquiring bank was non-local, representing a new competitor in the local marketplace. They were also greater in those markets where the potential for efficiency gains were thought to be greatest, i.e., where banks had been protected from local competition because of market power.

24. Given the assumption-dependent nature of relative cost X-efficiency measures it is clear that one cannot reliably quantify welfare implications if their *levels* vary with the distributional assumptions used in the estimation. However, the robustness of the results using levels or rankings provides confidence to our claim that efficiency gains were realized.

25. For the total sample, the efficiency gains using the alternative measure are realized more quickly (in the first few years) than found using efficiency levels. However, similar to the findings with efficiency levels, they tend to be spread out more evenly over the 6-year period in the subsamples analyzed, particularly the less competitive subsample and mergers involving a non-local entrant. Again, the results are available from the authors on request.

We did not find the "significance" of the merger—measured as the share of local deposits acquired in the merger—to matter very much. Rather, any acquisition seemed to stimulate a response by local incumbents.

To evaluate potential sources of gains in cost efficiency, we also evaluate and find evidence of changes in accounting ratios consistent with incumbent banks curtailing expenses that they have most control over as they attempt to meet the increased competition in the local marketplace. We also found evidence consistent with an initial "depositor run-off" following mergers where customers of the acquired bank shift balances to alternative banks in the local market. This serves as an inexpensive source of funding but is short lived and is reversed after 2 years.

The efficiency gains from M&As are in addition to any resulting from increases in potential competition following the elimination of entry barriers. However, there are some inconsistencies in our findings concerning efficiency gains surrounding decreases in competitive barriers. While there are generally cost efficiency gains following the liberalization of restrictions on holding company expansion, we found perverse effects when intrastate branching restrictions are eliminated. We offer some potential reasons for this result, a result also found in previous studies evaluating the effect of deregulation in banking. Summarily, consistent with economic theory, our findings suggest that merger activity leads incumbent banks in the affected market to increase their productive efficiency to enable them to be viable in the more competitive environment. Thus, studies evaluating the impact of bank mergers on the efficiency of the combining parties alone may be overlooking the most significant welfare-enhancing aspect of merger activity.

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