FS 98-08 June 1998

Evaluating The Performance of Agricultural Bank Management: The Impact of State Regulatory Policies

Bernard K.N. Armah, Jr., Timothy Park, and C.A. Knox Lovell

The authors are graduate student, associate professor in the Department of Agricultural and Applied Economics, and professor in the Department of Economics, University of Georgia.

Dept. Of Agricultural and Applied Economics
College of Agricultural and Environmental Sciences
University of Georgia

Evaluating The Performance of Agricultural Bank Management: The Impact of State Regulatory Policies

Bernard K.N. Armah, Jr., Timothy Park, and C.A. Knox Lovell

Department of Agricultural and Applied Economics
University of Georgia
Athens, Georgia 30602
barmah@agecon.uga.edu

ABSTRACT---
We evaluate agricultural bank management performance, focusing on the impacts of interstate banking laws on productivity change. The generalized Malmquist productivity index decomposes productivity change into technological change, technical efficiency change, and change in scale economies. While managerial productivity rose from 1982 to 1991, states that adopted the most liberal interstate banking laws experienced the most improvement in productivity. Large agricultural banks were more efficient in states that had more liberalized interstate banking laws while small agricultural banks fared better in states with more restrictive laws.

Key Words: generalized Malmquist index, interstate banking, productivity change.

Evaluating The Performance of Agricultural Bank Management: The Impact of State Regulatory Policies

Introduction

Prior to 1978, no state permitted out-of-state acquisitions of its banks. Within twenty-five years the interstate banking regulations that had been in place for over a century disappeared as states adopted liberalized interstate banking laws. The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 allows banks to branch across state borders after June 1997 if states concur. Deregulation which had proceeded as a state and regional initiative effectively shifted to a uniform federal policy. Policy analysts and state legislators continue to examine whether these provisions benefit or hurt banks in their states.

The main objective of this study is to evaluate changes in the productivity of agricultural bank management linked to the banking deregulation using the generalized Malmquist index. This index enables us to investigate the contribution of scale economies to productivity change. For agricultural banks in states that had some form of interstate banking law prior to the Riegle-Neal Act, we estimate productivity change focusing on the impacts of interstate banking laws on the economies of scale and managerial productivity change. We examine the impacts of relaxing government restrictions on structural changes in agricultural banking by applying the generalized Malmquist index which explicitly incorporate the influence of scale economies on productivity change.

The survival of small local banks has been vital for the economic and social development of rural areas. Opponents of interstate banking assert that this policy could lead to the erection of new entry barriers. When large banking organizations acquire local banks and grow in market share, these institutions may apply newly acquired market power to carry out predatory pricing. This drives smaller competitors from the market and prevents the entry of new firms. With the concentration of local markets, banks with large market shares can increase fees on services, increase loan rates, and reduce rates of deposits, denying the public the benefits of more intense competition among suppliers of financial services. Thus, removing restrictions on interstate banking and branching might cause small banks to gradually disappear.

Supporters of interstate banking contend that removing interstate banking restrictions would result in the entry of more efficient banks into local markets where previously sheltered banks earn excess profits. Proponents argue that a intensified level of competition will eliminate inefficient banks and improve the quality and availability of financial services for consumers and small businesses.

The importance of the new regulatory regime is illustrated by examining the dramatic reductions in the number of agricultural banks. From 1980 to 1991, agricultural banks declined from 5,316 to 3,952 as 350 agricultural banks failed and 950 either consolidated or merged. The remaining 64 banks were taken over by the Federal Deposit Insurance Corporation which allowed solvent banks to take over control of the assets of the failed banks even across state lines.

Bank mergers have been justified by the existence of scale and scope economies. By contrast most studies of bank costs find increasing returns to scale only for small banks with less than $100 million in total assets and decreasing returns to scale for larger banks. Measuring the impacts of these changes on the performance of banks is critical given recent structural and legislative developments. Productivity measures that explicitly account for the impacts of scale economies will enable legislators and banking analysts to identify whether productivity changes are mainly driven by technical efficiency changes, changes in technology or movement toward operation at an optimal scale.

Regulatory Environment and Literature Review

We briefly describe the origins and development of banking regulation along with the types of interstate banking laws that have been adopted by states. Key studies examining the impacts of interstate banking on the structure and the profitability of the commercial banking industry and the effects of interstate banking on managerial skill are summarized. The analysis identifies key variables used in previous studies and the role of data aggregation in measuring the interstate banking impacts.

The first federal legislation focusing on the geographic scope of bank operations was the McFadden Act, passed in 1927 and amended in 1933, which permitted national banks the same branching opportunities that states allowed their state-chartered banks. Bank holding companies (BHCs) are banks that own one or more other banks and offer bankers an organizational form to circumvent intrastate branching restrictions. The Douglas Amendment of the Bank Holding Company Act of 1956 prohibited BHCs from acquiring banks in other states unless those states specifically allowed such acquisitions. The McFadden Act and the Douglas Amendment implied the right of each state to determine a legally enforceable position on interstate banking expansion.

By 1991 different forms of interstate banking laws had been adopted in the United States. The approaches to interstate legislation generally fit one of three basic categories: nationwide open-entry, national reciprocity, or regional reciprocity. Nationwide open-entry permitted acquisitions and other activities by bank holding companies found anywhere in the nation. This was the most liberal form of interstate banking law and the majority of the states in this group were found in the West. Reciprocity meant that out-of-state BHCs could make acquisitions in a given state only if those out-of-state BHCs were in states that granted similar privileges to BHCs in the other state. States that adopted the national reciprocity law were not aligned in any distinct geographic pattern across the United States.

Regional reciprocity meant that interstate banking was limited only to states specified in the state legislation and reciprocity was required. These compacts were usually limited to adjacent states or those next to the adjacent states. Most Southern states, including Alabama, Arkansas, and Georgia adopted this law. States that had not adopted any form of interstate banking law consisted mostly of Midwestern states with a large scale of agricultural activity.

Lence (1997) summarizes key trends influencing the structure of the banking industry since 1980, highlighting the role of economic forces driven by bank efficiency, market power, and portfolio diversification along with government forces such as the relaxation of branching and interstate banking restrictions. Most of the studies listed were based on individual bank data.

Our analysis is based on state level data to measure the impact of state characteristics as key determinants of bank efficiency. Panel data allow us to evaluate the impact of policy initiatives and shifting state regulatory strategies across cross-sectional units over time. States did not uniformly and consistently adopt similar banking regulations. By April 1, 1989 seven states, including California, Colorado, and Pennsylvania had some form of regional interstate banking law. In March 1990, Pennsylvania adopted national reciprocity while California and Colorado adopted the same law in January 1991. By observing these units over different points in time, panel data allow us to separate the effects of scale economies and technological change on productivity. The availability of extended panels of state level data permit us to focus on the sources of productivity changes identified in the generalized Malmquist index.

Other researchers have conducted studies concerning the impacts of the new intrastate branching and interstate banking laws on commercial banks. Berger, Kashyap, and Scalise undertake simulations using commercial bank data aggregated nationally from 1979 to 1994 which suggest that nationwide banking will result in substantial consolidation of the banking industry. The study concludes that little change will occur in the distribution of industry assets across organization size. Chong investigates the impacts of interstate banking on commercial banks' risk and profitability using capital market data and the event study methodology. The evidence shows that interstate banking improves the profitability of commercial banks and is associated with significant increases in the banks' exposure to market risk.

Hubbard and Palia examine whether a more competitive environment requires greater management skills in chief executive officers using interstate bank regulation as a measure of competitive conditions. Interstate regulations with fewer entry barriers lead to a higher level of potential competition and demand managers with greater skills, resulting in higher compensation levels for these managers. This evidence indicates that a more competitive environment creates the need for managers with greater managerial talent who can enhance the bank's competitive position.

Swamy *et al*. investigate the determinants of U.S. commercial bank performance from 1980 to 1993 using state-level commercial bank data on rates of return on assets (ROA) and equities (ROE). Explanatory variables include bank-specific variables, location restriction variables and a variable to measure general economic conditions. Locational restrictions such as barriers to entry significantly improve commercial bank profits. Berger also utilized ROA and

ROE in evaluating the banking industry.

Studies determining the impacts of the banking and branching restrictions have typically employed data aggregated at various levels such as industry, state, and national levels. Wallace uses state level data to analyze structural and efficiency changes in financial performance across agricultural and nonagricultural banks from 1980 to 1991. Although significant consolidation has occurred, small agricultural banks have stayed competitive and outperformed nonagricultural banks on several measures of profitability, liquidity, efficiency, and solvency.

McLaughlin utilizes aggregated bank holding company (BHC) data to examine the impacts of interstate banking and branching reform on the BHCs. Observed changes in bank behavior following liberalization of state branching and interstate banking from 1988 to 1993 show that BHCs responded quickly to state branching liberalization by consolidating their banks within states. However, the BHCs were slower to respond to interstate banking reforms to expand into additional states.

Mengle's analysis is based on individual and aggregated bank data to show that interstate branching is a logical and feasible step in the evolution of the geographical structure of American banking. The study outlines some arguments for interstate branching and then discusses ways of application, the likelihood of adoption, and possible effects on the bank structure in the United States. Mengle concludes that both banks and consumers would benefit from such a law and suggests that the number of large banks would decrease while small bank numbers would likely remain unchanged.

Model Development

Economides, Hubbard, and Palia develop a model of monopolistic competition between large and small banks that highlights the link between performance measurement and interstate banking restrictions. We outline the main features of the model here, focusing on its testable implications for assessing managerial performance in agricultural banks. Assume there are **M** banking markets with **m** participating banks in each market. Competition between banks takes place in a three-stage sequential model of differentiated products markets: banks enter, choose locations, and choose prices.

Small banks participate in only one market while large banks participate in **g** markets. The model determines the equilibrium price and number of banks and a profit function for each type of bank. The profits of bank *I* in market *j* are decreasing in the number of competitors in that market. Profits of small banks depend on one market only. Profits per branch of large banks participating in **g** markets are

(1) $$\Pi^{l}(\boldsymbol{P},\ \boldsymbol{m}) = \sum_{j=1}^{\boldsymbol{g}} \frac{\Pi_{i,j}(\boldsymbol{P},\ \boldsymbol{g},\ \boldsymbol{m})}{\boldsymbol{g}}$$

where **P** is a vector of all prices for all markets in which the large bank participates.

Depositors are informed about bank profitability by identifying banks that operate in multiple markets. Large banks have lower levels of profit variability than smaller banks by diversifying their portfolios across multiple markets. This risk-pooling argument applies even if all markets represent identical distributions. Drawing from economic activity across the geographic markets that are negatively correlated is an additional factor that lowers the variability of profits for large banks relative to small banks.

To attract additional deposits, banks that operate in only one market respond by holding more capital per dollar of assets than banks operating in many markets. Small banks hold more equity capital per branch than large banks. Large banks have higher profits than small banks in any market in which both types of banks participate.

Absent restrictions on interstate banking, the free-entry equilibrium is determined by the zero profit condition for large banks. Profits of large banks with no interstate banking restrictions are Π_B^l and the free-entry equilibrium number of banks is given by $\Pi_B^l = 0$. At this level of competition small banks have losses, $\Pi_B^s < 0$, depicted in figure 1 as the segment CD.

Under the most severe entry restrictions no interstate banks enter and the zero-profit condition of small banks determines the number of banks in each market. The profit function for small banks in figure 1 illustrates the equilibrium. Small banks make zero profits and survive; large banks reap positive profits indicated by the segment AB.

The model yields a set of testable predictions for assessing banking performance. In the absence of banking restrictions the competitive position of small banks is eroded. In markets where small banks are dominant, Economides, Hubbard, and Palia suggest that interstate banking regulation allows small banks to deter entry by large banks. These results imply that assessments of bank performance and productivity should be based on profitability measures plus characteristics specific to the environment in which banks operate.

Measuring Productivity Change Using the Generalized Malmquist Productivity Index

The technical efficiency of a production unit is a comparison between observed and optimal values of its output and input. This comparison can take the form of the ratio of observed to maximum potential output obtainable from the given input. Alternatively, we may define it as the ratio of minimum potential to observed input required to produce the given output, or some combination of the two.

In this section, we discuss the generalized Malmquist productivity index which we use to measure and decompose bank management productivity change into technical efficiency change, technological change, and change in scale economies. The generalized Malmquist index, proposed by Grifell-Tatjé and Lovell, explicitly incorporates the influence of scale economies on productivity change and accounts for three key components of efficiency changes over time.

First, firms adopt innovative technological and marketing techniques and induce the frontier technology to shift outward over time. The index T captures this component which reflects changes in technology between the two periods or shifts in the production frontier (innovation) so T is a measure of technological change.

The second component arises because banking firms undergo changes in technical efficiency over time as they respond to competitive pressures and adjust marketing strategies. Index E accounts for this and reflects productivity change arising from changes in technical efficiency between t and $t + 1$. This index E measures a firm catching up to the best practice frontier and represents technical efficiency change.

Third, large banks may achieve economies of scale over time as they spread productive resources over multiple products more efficiently. Managers may exploit these efficiencies to combine a bank and an insurance agency and sell loans, acquire deposits, and market insurance policies in one organization. The scale index S, measures this third component and attains a value greater than unity if a change in the producer's scale of production contributes positively to productivity change. A change in the scale of production positively affects productivity change if it is a movement toward the technically optimal scale. The index of change in scale economies ensures that the generalized Malmquist index does not overstate productivity change when input growth occurs in the presence of decreasing returns to scale.

An output-oriented generalized Malmquist index of productivity can be expressed as

(2) $$G(x^{t+1}, y^{t+1}, x^t, y^t) = T * E * S,$$

where, the right-hand side elements in equation (2) are

(3)
$$T = \left[\frac{\mathbf{D_o}^t(x^{t+1}, y^{t+1})}{\mathbf{D_o}^{t+1}(x^{t+1}, y^{t+1})} \frac{\mathbf{D_o}^t(x^t, y^t)}{\mathbf{D_o}^{t+1}(x^t, y^t)} \right]^{1/2},$$
$$E = \left[\frac{\mathbf{D_o}^{t+1}(x^{t+1}, y^{t+1})}{\mathbf{D_o}^t(x^t, y^t)} \right],$$
$$S = \left[\frac{\mathbf{D_c}^t(x^{t+1}, y^t)}{\mathbf{D}^t(x^{t+1}, y^t)} \frac{\mathbf{D}^t(x^t, y^t)}{\mathbf{D_c}^t(x^t, y^t)} \right].$$

The calculation and decomposition of the generalized Malmquist index requires the calculation of output distance functions for each cross-sectional unit. The efficiency score in outputs for the kth firm at a point in time t, $\mathbf{D_o}^t(x^t_k, y^t_k)$, is obtained from the following linear programming model:

(4)

$$
\begin{aligned}
[\boldsymbol{D_o}^t(x_k{}^t, y_k{}^t)]^{-1} &= Max\ \theta \\
s.t. \quad \theta y_{kn}{}^t &\leq \sum z_k y_{k'n}{}^t \qquad n = 1,...N \\
\sum z_k x_{k'm}{}^t &\leq x_{km}{}^t \qquad m = 1,...M \\
z_k &\geq 0 \qquad k = 1,...K,
\end{aligned}
$$

where the z_k are intensity weights that allow convex combinations of data points. Superscripts on the functions represent the technology defined by the data. Subscript **k'** refers to a specific cross-sectional observation and subscripts **n** and **m** refer to outputs and inputs. $\mathbf{D}^{t+1}(x^{t+1}, y^{t+1})$ is solved in a similar manner, substituting period *t+1* data for *t* data.

The mixed distance function $\mathbf{D}^t(x^{t+1}, y^{t+1})$ is estimated by comparing observations in period *t+1* with the best-practice frontier of period *t*. $\mathbf{D}^{t+1}(x^t, y^t)$ uses data from both periods to evaluate (x^t, y^t) relative to technology constructed from *t+1* data. In estimating the distance functions for the index of scale economy change, $\mathbf{D}_c{}^t(x^{t+1}, y^t)$ evaluates data comprising of period *t+1* inputs and period *t* outputs using period *t* technology. The subscript **c** shows that the distance function is defined relative to some constant returns to scale technology. $\mathbf{D}^t(x^{t+1}, y^t)$ performs the same evaluation as $\mathbf{D}_c{}^t(x^{t+1}, y^t)$ but defines the distance function relative to a variable returns to scale technology.

After solving these six linear programming problems for each set of observations, we insert the values into equation (2) to obtain the generalized Malmquist index and its components. An index below unity shows a decline in productivity while a value exceeding one suggests growth.

Data and Variables

This section discusses the data and measures of inputs and outputs used in the analysis. The estimates of the productivity indexes were based on annual statewide aggregate data for agricultural banks for 1982 and 1991 using information on the agricultural and nonagricultural banking performance from Wallace. We focus on data that was available for 36 states for both sample periods, building on the insights presented by Swamy *et al*. and Berger, Hanweck, and Humphrey who also used state level data in their analyses of U.S. commercial banks.

Banks consolidate or merge to ensure an increase in present or future profits. They operate in markets and engage in activities that boost their current or future profits. We measure managerial performance using profitability measures consistent with Swamy *et al.* and Boyd and Gertler. Managers of financial institutions and other industry professionals evaluate bank performance based on financial ratios derived from balance sheets and income statements. Profitability ratios measure the ability of the firm to produce net returns sufficient to sustain survival and growth and serve as an indicator of bank management's response to changing market conditions.

The output variables chosen for this study are two ratios drawn from the profitability measures -- the rate of return on assets (ROA) and the rate of return on equity (ROE). The return on assets is calculated as profits per dollar of assets and provides a gauge of how well a bank's management uses its assets. Together with the risk profile, ROA can be employed in assessing a bank's ability to absorb losses before its capital position is threatened.

We select state level factors that potentially affect the loan base of agricultural banks as inputs. This set of state variables includes the average farm size, the number of farms, the average market value of agricultural products sold, the average value of Commodity Credit Corporation loans received, the average value of land and buildings, and the average value of equipment and machinery per farm. These factors largely affect the borrowers' equity positions and their loan repayment abilities. Bank management attempts to harness these local attributes of the agricultural sector in the efficient operation of their institutions.

Results and Discussion

In this section we examine productivity change and its components for agricultural bank management under each interstate banking regime. The effects of shifts in technical efficiency, technological change, and the impact of scale economies on productivity change are presented to assess how these effects are related to interstate banking regimes. The analysis highlights the bias caused by neglecting the role of scale economies in productivity change.

Table 1 summarizes the geometric means of managerial productivity change and its components for the different banking regimes. We calculate the index of productivity change and evaluate the changes in its components for the individual states under each interstate banking regime from tables 2 to 5.

As indicated in column 5 of table 1, productivity rose by 39.3 percent from 1982 to 1991 with the primary source of productivity growth due to technological progress which increased by 28.3 percent, indicated in column 2 of table 1. More significantly, the remaining managers were more than able to keep up with the improvements in best practice as evidenced by the 6.7 percent increase in managerial efficiency displayed in column 1 of table 1. These results indicate that agricultural bank managers adapted well to the more liberalized regulatory climate. A positive relationship exists between size and productivity change and may explain the redistribution of banks to higher size classes as managers capture economies of scale.

The expanded scale of potential entrants increased competition in the market for agricultural lending. We use term potential entrants because some states were due to permit bank entry from more states outside their previously defined region. For instance, Colorado was scheduled to switch from regional reciprocal interstate banking to nationwide banking by July 1993. Kansas and New Mexico, states that permitted no form of interstate banking, had committed to adopt regional reciprocal and nationwide interstate banking laws respectively, by July 1992. Managers of larger banks more efficiently employed local resources in the operation of their institutions. For banks in states such as Kentucky, Pennsylvania, and West Virginia that recorded a scale index of 1 as found in column 4 of table 3, efficiency was mainly due to diversification of outputs and inputs under constant returns to scale. Here, small and large agricultural banks could easily coexist since the size of the bank yielded no advantages.

For banks in states with nationwide open-entry, the fifth column of table 1 shows that productivity rose by 69.5 percent with an average scale index of 1.229 (column 4, table 1). This suggests a positive relationship between size and productivity change as large banks were more efficient under these competitive conditions than small banks. This finding is consistent with the results of Billingsley and Lamy that larger BHCs were expected to reap greater benefits from nationwide interstate banking. Technological improvements for banks under this regime were slower than in any other group at 11.6 percent. The measure of technical efficiency change indicates that bank managers kept up with improving technology at a faster rate (23.5 percent) than those in more restrictive banking regimes.

Productivity changes for states with national and regional reciprocity laws were lower. For agricultural banks in states with national reciprocity, the improvement was 36.1 percent while that for agricultural banks in regional reciprocity states was 33.5 percent. These results are both displayed in column 5 of table 1. Restrictions on entry by banks from other states may have limited potential or actual competition. As a result local banks may have gained an increase in market power and did not have to operate at the most efficient level to increase their levels of profit. From column 4 of table 1 we observe that the average scale indices were 0.974 and 0.968, respectively, indicating that more restrictive conditions seemed to favor small agricultural banks.

Featherstone and Moss (1994) estimate economies of scale and scope in agricultural banking by disaggregating outputs used in agricultural lending. Based on 1990 Call Reports from 7,108 rural or agricultural banks, they report an overall economies of scale measure of 0.986 indicating nearly constant returns to scale. Economies of scale are exhausted at bank sizes exceeding $60 million. This result is consistent with the measures obtained here for banks operating under the more restrictive banking regimes where scale economy measures of 0.974 and 0.968 were obtained. Both findings suggest that restrictive interstate banking and branching laws favor small agricultural banks.

These results reinforce implications from the Economides, Hubbard, and Palia model which suggest that interstate banking restrictions enhance the competitive position of small banks. The empirical findings align with those presented in Swamy *et al.* who found that profits for commercial banks were higher in states with substantial barriers to entry. Under reciprocity regimes, the main driving force of productivity change was technological change. Berger, Kashyap, and Scalise noted that technological and financial innovations, including improvements in information processing and telecommunications technologies, plus the dramatic increases in automated teller machines over this period played an important role in transforming the banking industry. These developments confirm the significant role of technological change in productivity growth. The changes in productivity and the impact of the productivity components were similar for both types of interstate banking reciprocity laws. This suggests that there is little advantage in restricting interstate banking to a smaller region rather than nationwide.

With no interstate banking entry, managerial productivity rose by 36.5 percent as indicated in column 5 of table 1. As demonstrated in columns 2 and 1 of table 1 respectively, technology improved at a high rate of 14.8 percent while the rate of technical efficiency increase was lower at a rate of 3.2 percent. These figures may reflect bank responses to potential competition. For example in 1992, Kansas and New Mexico were due to adopt the regional and national reciprocity laws respectively.

Column 3 of table 1 shows the indices of productivity change net of scale economies and demonstrates the importance of using the generalized Malmquist index for evaluating productivity change in agricultural banks. A value for the scale index greater than unity indicates that a change in the producer's scale of production contributes positively to productivity change. A positive contribution to productivity results from expansion under increasing returns or contraction of production in the region of decreasing returns to scale.

The figures in table 1 demonstrate that neglecting scale economies in measuring productivity change in agricultural bank management causes the actual productivity growth to be understated for states with nationwide open-entry where output growth occurred in the presence of increasing returns to scale. For states with some form of reciprocity law, productivity growth net of scale economies overstates actual growth in productivity since outputs expanded in the region of decreasing returns to scale. A change in the scale of production contributes to a decline in productivity change if it is away from the direction of the technically optimal scale.

Summary and Conclusions

The purpose of this study was to evaluate the performance of agricultural bank management from 1982 to 1991 facing different types of interstate banking laws. A generalized Malmquist productivity index highlights the contribution of scale economies to productivity change. We evaluated the effects of shifts in technical efficiency, technological change, and the impact of scale economies on productivity change in agricultural banks. The magnitudes of these impacts are related to different types of interstate banking regimes.

Results showed that managerial productivity change, measured by the generalized Malmquist index, did increase over the period by 39.3 percent. States that had adopted or were about to adopt the most liberal interstate banking laws experienced the most improvement in productivity.

We observed an overall positive relationship between agricultural bank size and productivity. Large agricultural banks were more efficient in states that had a more liberalized interstate banking law while small agricultural banks fared better in states with more restrictive laws. Neglecting the impacts of scale economies on productivity change causes us to understate actual productivity growth and the efficacy of the generalized Malmquist index in eliminating this bias is confirmed in evaluating productivity growth in states with nationwide open-entry.

We conclude that interstate banking reforms enhance managerial productivity of agricultural banks and allows managers to take advantage of economies of scale. Thus, the

Riegle-Neal provision for national interstate banking will eventually be profitable for states. However, managers have to adopt more efficient practices in the operation of small banks. High costs of adjustment limit the ability of small banks to expand. For small agricultural banks to survive in the more liberalized markets, managers can operate more efficiently by making use of their specialized knowledge of local client information.

References

Berger, A.N. "The Relationship Between Capital and Earnings in Banking." *Journal of Money, Credit and Banking* 27(1995):432-456.

Berger, A.N., G.A. Hanweck, and D. Humphrey. "Competitive Viability in Banking." *Journal of Monetary Economics* 20(1987):501-520.

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

Billingsley, R.S. and R.E. Lamy. "Regional Reciprocal Interstate Banking: The Supreme Court and the Resolution of Uncertainty." *Journal of Banking and Finance* 16(1992):665-686.

Boyd, J.H. and M. Gertler. "U.S. Commercial Banking: Trends, Cycles and Policy." Working Paper No. 4404, National Bureau of Economic Research, 1993.

Chong, B.S. "The Effects of Interstate Banking on Commercial Banks' Risk and Profitability." *The Review of Economics and Statistics* 73(1991):78-84.

Economides, N., R.G. Hubbard, and D. Palia. "The Political Economy of Branching Restrictions and Deposit Insurance: A Model of Monopolistic Competition Among Small and Large Banks." *Journal of Law and Economics* 39(1996):667-704.

Featherstone, A.M. and C.B. Moss. "Measuring Economies of Scale and Scope in Agricultural Banking." *American Journal of Agricultural Economics.* 76(August 1994):655-661.

Grifell-Tatjé, E. and C.A.K. Lovell. "The Sources of Productivity Change in Spanish Banking." *European Journal of Operational Research* 98(1997):364-380.

Hubbard, R.G. and D. Palia. "Executive Pay and Performance: Evidence from the U.S. Banking Industry." *Journal of Financial Economics* 39(1995):105-130.

Lence, S.H. "Recent Structural Changes in the Banking Industry, Their Causes and Effects: A Literature Survey." *Review of Agricultural Economics.* 19(Fall/Winter 1997):371-402.

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

McLaughlin, S. "The Impact of Interstate Banking and Branching Reform: Evidence from the States." Federal Reserve Bank of New York, *Current Issues in Economics and Finance* 1(1995):1-6.

Mengle, D.L. "The Case for Interstate Branch Banking." Federal Reserve Bank of Richmond, *Economic Review* 76(1990):3-16.

Swamy, P.A.V.B., J.R. Barth, R.Y.Chou, and J.S. Jahera, Jr. "Determinants of U.S. Commercial Bank Performance: Regulatory and Econometric Issues." *Research in Finance* 14(1996):117-156.

Wallace, G.B. "Agricultural and Nonagricultural Banking Statistics." Washington, D.C.: USDA ERS, Statistical Bulletin No. 883, 1994.

Table 1. Geometric Means of Productivity Change for the Different Regimes

Regimes	Technical Efficiency Change Index	Technological Change Index	Productivity Change Net of Scale Effects	Scale Index	Generalized Malmquist Index
All Regimes	1.067	1.283	1.369	1.017	1.393
Group 1	1.235	1.116	1.379	1.229	1.695
Group 2	1.077	1.297	1.398	0.974	1.361
Group 3	1.011	1.365	1.379	0.968	1.335
Group 4	1.032	1.148	1.119	1.151	1.365

Group 1. Banks in States with Nationwide Open Entry
Group 2. Banks in States with Nationwide Reciprocal Entry
Group 3. Banks in States with Regional Reciprocal Entry
Group 4. Banks in States with No Interstate Banking Laws

Table 2. Indices of Productivity Change for Banks in States with Nationwide Open Entry (Group 1)

States	Technical Efficiency Change Index	Technological Change Index	Productivity Change Net of Scale Effects	Scale Index	Generalized Malmquist Index
Idaho	1.611	0.978	1.576	1.400	2.205
Oklahoma	1.184	1.476	1.748	1.184	2.069
Texas	0.924	1.108	1.024	1.023	1.047
Utah	1.560	1.198	1.869	1.583	2.957
Wyoming	1.047	0.978	1.024	1.047	1.071
Geometric Mean	1.235	1.116	1.379	1.229	1.695

Table 3. Indices of Productivity Change for Banks in States with National Reciprocal Entry (Group 2)

States	Technical Efficiency Change Index	Technological Change Index	Productivity Change Net of Scale Effects	Scale Index	Generalized Malmquist Index
California	1.176	1.336	1.571	0.978	1.537
Illinois	0.944	1.483	1.400	0.827	1.157
Kentucky	1.000	1.433	1.433	1.000	1.433
Louisiana	0.963	1.321	1.272	0.985	1.253
Michigan	1.201	1.328	1.595	0.935	1.491
Nebraska	1.103	1.445	1.594	1.061	1.691
New York	0.962	1.446	1.391	0.970	1.348
North Dakota	1.307	1.287	1.682	1.096	1.843
Ohio	1.218	1.511	1.840	0.898	1.652
Pennsylvania	1.000	1.462	1.462	1.000	1.462
South Dakota	1.483	1.366	20.026	1.099	2.225
Vermont	0.733	0.577	0.423	0.733	0.310
Washington	1.204	1.096	203	1.132	1.494
West Virginia	1.000	1.502	1.502	1.000	1.502
Geometric Mean	1.077	1.297	1.398	0.974	1.361

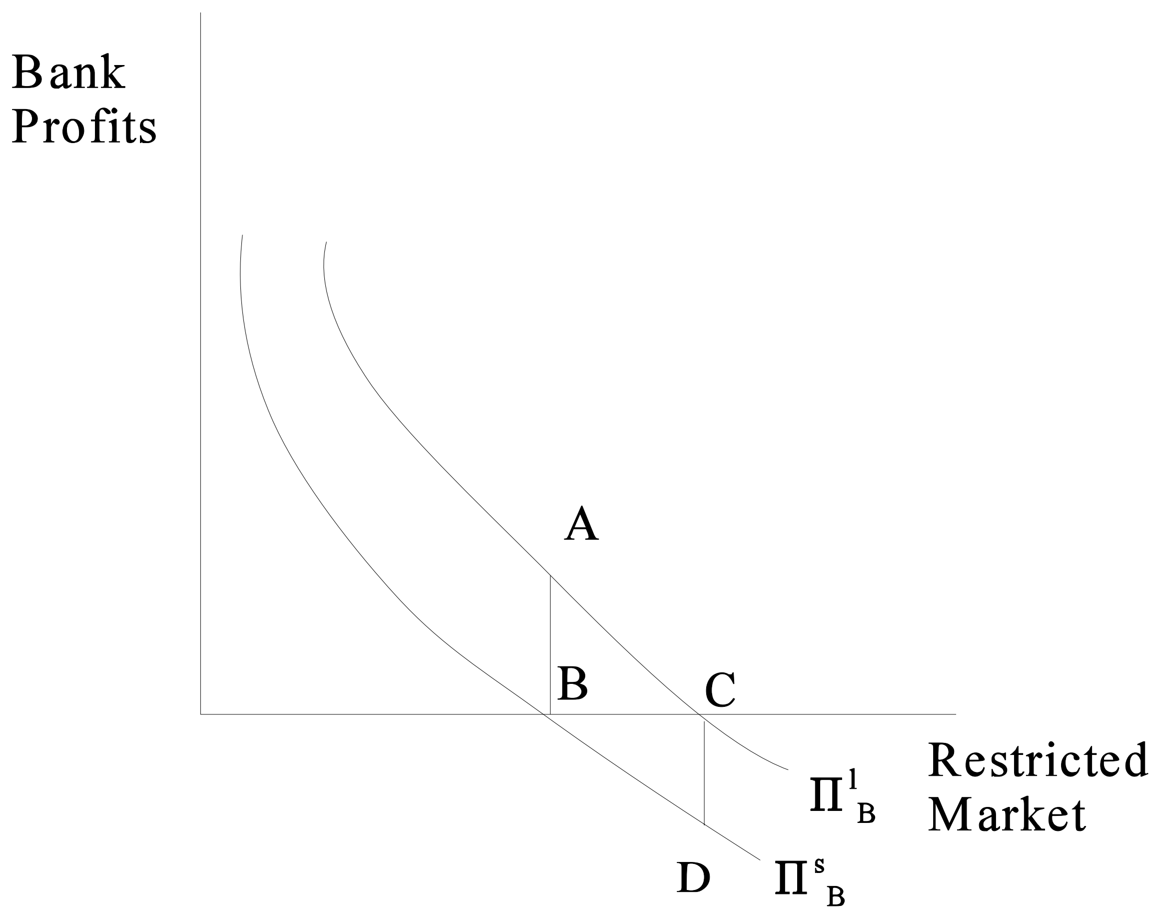
Table 4. Indices of Productivity Change for banks in States with Regional Reciprocal Entry (Group 3)

States	Technical Efficiency Change Index	Technological Change Index	Productivity Change Net of Scale Effects	Scale Index	Generalized Malmquist Index
Alabama	0.701	1.425	0.999	0.954	0.953
Arkansas	1.267	1.329	1.685	0.946	1.594
Colorado	1.038	1.060	1.100	1.060	1.166
Florida	0.647	1.541	0.997	0.792	0.789
Georgia	0.974	1.369	1.333	1.008	1.345
Indiana	1.378	1.490	2.033	0.874	1.795
Iowa	0.960	1.464	1.405	0.883	1.241
Maryland	1.069	1.509	1.613	1.069	1.724
Minnesota	0.970	1.324	1.284	0.938	1.204
Mississippi	1.211	1.214	1.470	1.061	1.559
Missouri	1.175	1.146	1.347	1.058	1.424
Tennessee	0.938	1.428	1.340	0.938	1.257
Virginia	1.131	1.478	1.672	0.999	1.669
Wisconsin	0.964	1.436	1.384	1.017	1.409
Geometric Mean	1.011	1.365	1.379	0.968	1.335

Table 5. Indices of Productivity Change for Banks in States with No Interstate Banking (Group 4)

States	Technical Efficiency Change Index	Technological Change Index	Productivity Change Net of Scale Effects	Scale Index	Generalized Malmquist Index
Kansas	1.382	1.345	1.859	1.298	2.413
Montana	1.140	1.108	1.263	1.136	1.434
New Mexico	0.699	1.015	0.710	1.034	0.734
Geometric Mean	1.032	1.148	1.119	1.151	1.365

Figure 1. Profit functions of large and small banks, under regulatory restrictions.



Π^l_B - profits of large banks
Π^s_B - profits of small banks