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Bank Concentration and Performance

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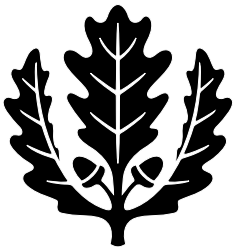

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Abstract

Regulatory change not seen since the Great Depression swept the U.S. banking industry beginning in the early 1980s, culminating with the Interstate Banking and Branching Efficiency Act of 1994. Significant consolidations have occurred in the banking industry. This paper considers the correlation, if any, between banking concentration on a state-by-state basis and average bank profitability within a state, finding strong support for a positive correlation. Moreover, temporal causality tests imply that bank concentration leads bank profitability. Our finding suggests that bank regulators need to monitor the consolidation process to head off the accumulation of monopoly power.

Journal of Economic Literature Classification: E5, G2

Keywords: commercial banks concentration, profitability

1. Introduction

The twentieth century witnessed two periods of dramatic regulatory and structural change in the U.S. banking industry – the Great Depression and the 1980s and 1990s. While many important regulations were enacted during the Great Depression, the 1980s and 1990s experienced the repeal and/or reversal of most depression-era financial regulations. Moreover, the last two decades also saw the transformation of the banking industry from one with much geographic limitation on banking and branching to one that now allows interstate banking and branching.

The 1980s and early 1990s also experienced severe financial turbulence – the savings and loan debacle followed by the crisis in the commercial banking industry. Those crises led to failure rates among financial institutions not seen since the Great Depression. Furthermore, those financial problems triggered many of the regulatory changes that occurred in the 1980s and 1990s. Conventional wisdom suggests that the emergence of interstate banking and branching generated a significant increase in mergers and acquisitions (Rhoades 2000, and Jeon and Miller 2002b). One view of the consolidation process in the banking industry suggests that it is by and large a positive event -- banks became more efficient (Jayaratne and Strahan, 1997, 1998). Another view sees a possible negative effect of consolidation on the availability of loans to small businesses (Ely and Robinson, 2001).

Our paper examines a part of the old structure, conduct, and performance triad in industrial organization. More specifically, we consider the correlation, if any, between bank consolidation and bank performance. In other words, are more concentrated markets more profitable? We find that bank profitability does correlate positively with bank concentration

within a state, even after adjusting for the economic environment within that state. In addition, temporal causality tests imply that bank concentration leads (causes) bank profitability.

The next section discusses recent events in the U.S. banking industry, emphasizing changes in market concentration and bank performance Section 3 provides background information concerning our tests of bank concentration and performance – that is, market definition, concentration measures, and profit-structure relationships. Section 4 describes the data, proposes the hypothesis tests, and reports the results. Section 5 concludes.

2. Market Concentration and Bank Performance

The history of banking in the United States provides important background information for understanding how we got to where we are today. The founding fathers were concerned about concentrations of power – political and/or economic. That predisposition helps to explain the various facets of regulation that speak to the operation of branch banks. Initially, banks were chartered within states and were prohibited from operating across state lines. When the National Banking Act of 1863 established the possibility of a federal charter, those newly established banks with federal charters were also prohibited from operating across state boundaries. Only in the mid-1980s did the dikes holding back the waters of a true interstate banking system began to crumble. The Interstate Banking and Branching Efficiency Act of 1994 opened the sluice gates to full interstate banking, a process that is still working itself out.

In recent papers, Rhoades (2000) and Jeon and Miller (2002b) outline the effects of U.S. commercial bank merger activity on banking structure. Several points deserve mention. First, the merger activity that began in the early 1980s continued through the late 1990s. Of course, the sustained merger activity was first precipitated by the pressure within the banking industry to

consolidate and then aided and abetted by the regulatory reform, culminating with the Interstate Banking and Branching Efficiency Act of 1994.[1]

Second, Rhoades (2000) argues that concentration in bank deposits among the top-25 and top-100 organizations rose between 1980 and 1998.[2] Surprisingly, Rhoades (2000) also reports that concentration, measured by the Herfindahl-Hirschman index and the percent of deposits held by the top-3 bank organizations, at the local level (MSAs and non-MSAs) hardly changed over the sample period. Jeon and Miller (2002b) report that concentration in bank assets among the top-5, top-10, top-20, top-50, and top-100 banks, not organizations, exhibited a U-shaped pattern, falling in the 1980s and rising through the 1990s. That finding is consistent with Rhoades's (2000) observation that the 1990s ushered in more large-bank merger activity. Jeon and Miller (2002b) then consider the top-5 and top-10 bank concentration ratios (percent of assets held by 5 and 10 largest banks, not organizations) on a state-by-state basis. The average concentration across states increased almost monotonically from 1976 to 1998. The top-5 ratio rose from 45.2 in 1976 to 61.6 in 1998 while the top10 ratio rose from 55.4 to 70.8.[3]

Third, Rhoades (2000) notes that the bank profit rate rose throughout the 1990s. He attributes that observation to an improving economy, stating that the increased profits "almost certainly reflect, to a large degree, this extraordinary performance of the U.S. economy and have

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[1] Stiroh and Poole (2000) ask whether the rising concentration of bank assets in the 1990s reflects expansion of exiting organizations or mergers with other organizations. They conclude that the bulk of the expansion reflects merger activity.

[2] The variable bank organizations treats a bank holding company as one entity, aggregating the balance sheets and income statements of all banks within the holding company to one grand balance sheet and income statement. Jeon and Miller (2002b) treat each bank within a holding company as a separate entity.

[3] Jeon and Miller (2002b) no longer report that information in their forthcoming paper, but will make it available to interested readers.

probably been contributing factors to the bank merger movement." (p. 30). That is, Rhoades (2000) argues that higher profits led to more mergers. An alternative explanation suggests that merger activity led to increasing concentration and that increased market concentration led to increased profits.[4] We test those hypotheses in the next section using state-level, time-series data.

3. Market Definition, Concentration Measures, and Profit-Structure Relationships

This section discusses three different, but related, issues that prove important in our econometric tests. To develop a concentration measure, we need to determine the geographic spread of the relevant market. Moreover, several different hypotheses exist to explain the direct profit-structure linkage.

Market Definition

The link, if any, between market concentration and bank performance received considerable attention, especially during the 1980s immediately after a significant number of deregulatory changes in the banking industry. The conventional wisdom then, and now, argues that policy makers should consider whether bank consolidation leads to excessive market power in retail, rather than wholesale, markets. That is, wholesale markets reflect national, if not global, reach; whereas retail markets reflect relatively small geographic areas -- metropolitan statistical areas (MSAs) or counties. Consequently, prior tests of bank consolidation on bank performance used MSA and/or non-MSA county data. Researchers and policy makers generally adopt geographic regions smaller than the state as the "relevant market" for analyzing whether a new charter makes sense in a specific region.

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[4] In the same section, Rhoades (2000) also noted that "the number of bank mergers reached peak levels during the mid-1980s, at which time industry profit rates … were quite low. This finding is somewhat surprising because high … profits are widely believed to be conducive to merger activity." (p. 31). Our alternative explanation fits nicely

Radecki (1998) argues, however, that events may require a rethinking of that long-held view. To wit, two decades of deregulation of geographic restrictions on banking and branching operations may now make the state the geographic level at which policy makers and researchers should address the concentration and performance issues. Radecki (1998) employs a number of observations to bolster his case. First, researchers find that large banks within a state now post uniform prices for bank services across the whole state and do not post different prices for different geographic regions within a given state. Second, smaller community banks must compete with the larger banks, even though they may only operate within one of the states traditional geographic regions. That is, competition with large banks equalizes the pricing of bank services across the entire state, even though small community banks may not operate in the whole state. Third, and interestingly, large banks that operate in several states still post different prices for bank services in different states, although they post uniform prices within a given state.

In sum, deregulation of geographic restrictions on banking and branching operations now may make it more sensible to examine the linkages between bank concentration and bank performance on a state-by-state analysis, rather than an MSA and non-MSA county analysis.

Concentration Measures

Since we adopt the state level as the "relevant market," we calculate our measures of concentration at that level. We employ three measures of bank concentration – the percent of assets held by the five largest and ten largest banks in a state as well as the Herfindahl-

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with this observation. Merger activity preceded the improvement in profits.

Hirschman index, which equals the sum of the squared of the percent of total assets held by each (and every) bank.[5]

The passage of the Reigle-Neil Interstate Banking and Branching Efficiency Act of 1994 eliminated the last vestiges of geographic restrictions on banking and branching operations in the U.S. It also created a methodological issue for our measures of concentration. Before the Reigle-Neil Act, the balance sheet and income statement information on a bank's operation within a given state was reported by that bank within that state, even if that bank belonged to a multibank holding company headquartered in another state. Now, however, interstate consolidations of bank operations can, but does not always, occur. When that consolidation happens, the balance sheet and income statement information for a given bank in a given state incorporates the information from other banks that it owns in other states. The Act permitted such consolidations after July 1, 1997, but allowed states to enact the provision earlier, if they so chose. And about half of the states did so (Sprong 2000, pp. 177-78). NationsBank provides the extreme example of such consolidations, growing from $31 billion in assets in 1994 to $79 billion in 1995 (Stiroh and Strahan 2002), after consolidating many banks from other states into its North Carolina operations. As a result, the measures of concentration rise in North Carolina, even though nothing real changed, and the concentration measures in the other involved states probably rises as well, unless the acquired bank in the other state was a large bank in which case the concentration measure could fall. Thus, as a theoretical proposition, our measures of

[5] As argued in the section on profit-structure relationships, the top-5 and top-10 measures capture the idea of relative market power whereas the Herfindahl-Hirschman index captures the idea of structure-conduct-performance.

concentration provide biased measures after 1994, suggesting that we may want to end our analysis with 1994.[6]

As a practical matter, however, the effect of interstate consolidation may not yet lead to significant bias. Jeon and Miller (2002b) report that most mergers and acquisitions still occur on an intrastate, rather than an interstate, basis. Interstate mergers jumped to about one-third of all mergers in both 1997 and 1998 at around 200 interstate mergers per year out of a total of 600 mergers per year (Jeon and Miller 2002b, Table 1). Viewed differently, Jeon and Miller (2002b, Table 1) also report 11,055 mergers from 1976 to 1998, of which 614 involved interstate mergers and almost two-thirds (399) of these occurred in 1997 and 1998.

In sum, our measures reflect some bias after 1994.[7] Thus, we perform our analysis for the full sample from 1976 to 2000 and from 1976 to 1994. The two analyses provide similar findings. We report that results from the longer sample, indicating where the results differed between the two samples.

Profit-Structure Relationships

The profit-structure relationship has received considerable attention in the industrial organization and banking literatures. Typically, a positive correlation emerges between profitability and concentration or market share. Berger (1995) argues that two competing theories can explain such positive correlations – market power and efficient structure theories.

The market-power theory includes two hypotheses – the traditional structure-conduct-performance and the relative-market power hypotheses. The structure-conduct-performance

[6] Stiroh and Strahan (2002) make a similar argument and do not extend their analysis beyond 1994.

[7] If the measurement of concentration exhibits a random bias, then the regressions of profit onto concentration and other independent variables biases the estimated coefficient on concentration toward zero, making it harder to find

hypothesis argues that more concentrated markets lead to higher loan rates and lower deposit rates because of lessened competition where as the relative-market power hypothesis argues that only large banks with some "brand identification" can influence pricing and raise profits. The difference between those two hypotheses revolves around whether market power proves generic to a market or specific to individual banks within a market.

The efficient-structure theory also includes two hypotheses – the X-efficiency and scale-efficiency hypotheses. The X-efficiency hypothesis argues that banks with better managements and practices control costs and raise profit, moving the bank closer to the best-practice, lower-bound cost curve. The scale-efficiency hypothesis argues some banks achieve better scale of operation and, thus, lower costs. Lower costs lead to higher profit and faster growth for the scale-efficient banks.

Berger (1995) claims that most prior tests of the market-power theories produce suspect findings, since they as a rule do not control for the efficient-structure theories. He provides a simultaneous test of all four competing hypotheses – two market-power and two efficient-structure – by adding measures of X-efficiency and scale efficiency to the standard tests. He finds support for only two of the four hypotheses – the relative-market-power and the X-efficiency hypotheses. His evidence does not support the structure-conduct-performance and scale-efficiency hypotheses.[8]

To implement his joint test, Berger (1995) uses individual bank balance sheet and income statement data to estimate a frontier cost function from which he derives the X-efficiency and

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significant effects. That we generally find significant effects strengthens our findings.

[8] Finding a significant effect for the X-efficiency, but not the scale-efficiency, hypothesis proves consistent with the empirical observation that X-efficiencies explains much more of differences in banks costs than do scale-

scale-efficiency measures for each bank over the 1980 to 1989 period. In addition, the relative-market-power hypothesis employs each bank's market share. In sum, the joint test employs three bank-specific variables – market share, X-efficiency, and scale efficiency – and one generic market variable – concentration.

As noted above, our analysis considers the state as the "relevant market" and uses aggregate return on equity for all banks in a state as the profit (performance) measure. That is, we do not employ individual bank data.[9] As a result, it appears that our analysis is subject to Berger's (1995) criticism of market power-performance tests. That is, we do not control for the two efficient-structure hypotheses. We do argue, however, that our measures of concentration capture the structure-conduct-performance and relative-market-power hypotheses. That is, the fraction of total assets in a state held by the top-5 and top-10 banks captures to some extent how the largest banks affect statewide return on equity – the relative-market–power hypothesis -- while the Herfindahl-Hirschman index uses all banks to generate a measure of statewide concentration.

How do we address the absence of variables to control for the efficient-structure hypotheses? Here, we argue that our second set of panel-data, temporal-causality regressions differentiate between the market-power and efficient-structure theories. The market-power theory implies that market power comes first followed by higher profits. That is, market power allows banks to manipulate prices, thus leading to higher profit. The efficient-structure theory implies that better managements and practices lead to higher profits and that better performances

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efficiencies (Berger, Hunter, and Timme 1993).

[9] Note that the return on equity at the state level easily rewrites as the weighted average of each bank's return on equity, where the weight equals the bank's share of statewide equity.

then lead to rising market share and concentration. In sum, the temporal causality tests differentiate between the market-power and efficient-structure theories.

4. Data, Hypotheses, and Regressions

We use the Report on Condition and Income (Call Report) data posted at the website of the Federal Reserve Bank of Chicago.[10] We calculate the number of banks in each state, the average return on equity in each state, and our measures of concentration – the percent of assets held by the top-5 and top-10 banks (top5 and top10) as well as the Herfindahl-Hirschman index of concentration (HHI) in each state and the District of Columbia for 1976 to 2000.[11] The data for the annual state level unemployment data come from the Bureau of Labor Statistics web site.[12]

Our maintained hypotheses are (1) that rising concentration in a state associates positively with and leads temporally the average rate of return on equity in that state; and (2) that an improved state economy, proxied by the state unemployment rate, associates positively with the average rate of return on equity in a state. As such, the market-power theory dominates the efficient-structure theory in explaining the observed data. We first perform panel regressions, using both fixed- and random-effect specifications, for the rate of return on equity as a function of the three measures of banking concentration separately. Then we add the number of banks to see if the absolute number of banks may affect the relationship between bank concentration and bank profitability (performance). Finally, we add the state unemployment rate, both with and

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[10] The web address is http://www.chicagofed.org/economicresearchanddata/data/bhcdatabase/bhcdatabase.cfm.

[11] The return on equity is measured as net income divided by equity and is calculated from the Call Report codes as {(RIAD4000 – RIAD4130)/RCFD3210}. We also run regressions (not shown, but available on request) involving total income to equity (RIAD4000/RCFD3210) and total expenses to equity (RIAD4130/RCFD3210). We refer to those additional regressions when appropriate in the text.

[12] The web address is http://stats.bls.gov.

without the total number of banks. Tables 1, 2, and 3 report the findings for the top-5, top-10, and Herfindahl-Hirschman measures of concentration, respectively.

Several consistent findings emerge. First, in all specifications, higher concentration associates with a higher rate of return on equity within a state. That is, increasing concentration of bank assets goes along with higher bank profitability. Moreover, that finding is robust to whether we include other control variables such as the state unemployment rate. Second, as expected, a higher unemployment rate associates with a lower rate of return on equity (lower bank profitability). That is, a healthy economy correlates with healthier bank performance (profitability). Third, little evidence suggests that the number of banks within a state significantly correlates with the rate of return on equity over and above the effects of the concentration measures and the unemployment rate.[13]

We noted in the introduction that one view of the consolidation process in the banking industry suggests that it is by and large a positive event -- banks became more efficient (Jayaratne and Strahan, 1997, 1998). By that, Jayaratne and Strahan (1997, 1998) mean that customers receive better treatment after deregulation than before. Our tests do not directly compare to their tests, unless a rigid relationship exists between deregulation and market concentration. To provide further information about our findings, we also run regressions of the total income to equity and total expense to equity ratios, the component parts of our return on equity measure of bank performance.

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[13] Similar findings emerge for the regressions that stop in 1994. We note, however, that the magnitude of the effects of the top-5 and top-10 measures of concentration in the full sample generally exceed those of the shorter sample. The results for the Herfindahl-Hirschman measure of concentration uniformly exhibit a smaller effect for the longer sample. In sum, the big mergers occur more frequently after 1994 suggesting that the top-5 and top-10 measures of concentration should have a larger effect for the longer sample and vice-versa for the Herfindahl-Hirschman measure. See Tables 1A, 2A, and 3A in the Appendix.

Several important observations emerge.[14] First, all the findings support the positive relationship between concentration and return on equity. When income and expense ratios both fall (rise), the expense (income) ratio falls (rises) by a larger magnitude.

Second, for the full sample period, the expense-to-equity ratio generally falls more than the income-to-equity ratio. Sometimes the effect of concentration on income to equity is not significant. Those results incorporate the 1995 to 2000 period and Jayaratne and Strahan (1997, 1998) discuss similar findings on loan rates responding to deregulation. Most importantly, when we add unemployment and number of banks to the regressions, then the results experience a consistent shift whereby income to equity now increases with concentration and expenses to income do not change. These later results also match the findings in the shorter sample.

Third, for shorter sample, the income to equity ratio generally rises more than the expense to equity ratio when concentration rises. Frequently, the expense to income ratio does not prove significant. Moreover, as we add unemployment and the number of banks to the regressions, the size and significance of the effect of concentration on the income-to-equity and expense-to-equity ratios generally gets larger and stronger.

Finally, since our interpretation of the relationship between bank profits and concentration relies on the market-power, rather than the efficient-structure, theories, we perform temporal causality tests between the average bank return on equity and our measures of concentration. [15] Table 4 reports the findings of bivariate vector autoregressions with three lags

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[14] While not reported, those results are available from the authors.

[15] Although typically applied in a time-series setting, a few researchers adopt Granger causality in a panel-data setting. Holtz-Eakin, Newey, and Rosen (1988, 1989) provide a good theoretical foundation while Nair-Reichert and Weinhold (2001), Podrecca and Carmeci (2001), and Jeon and Miller (2002a) report useful applications.

of each independent variable. We perform tests of short-run temporal causality (i.e., the coefficients jointly equal zero) and long-run temporal causality (i.e., the sum of the coefficients equals zero). We find strong evidence that our measures of state-level bank concentration temporally lead the average return on equity in that state for all specifications in both the short and long run. In addition, we find little evidence that the state average return on equity for banks temporally leads our measures of bank concentration in that state in the short or long run. In sum, the evidence supports our hypothesis that increasing bank concentration leads the appearance of improved bank profitability and not that higher bank profitability first contributed to increased merger activity and then to increased concentration.

Such temporal causality tests, however, may reflect spurious correlation due to an omitted variable. That is, a third event, an improving economy during the 1990s, for example, may explain the movement in bank profitability that does not relate to the changes in bank concentration. To test that possibility, Table 5 reports the findings of temporal causality tests from trivariate vector autoregressions that include return on equity, the unemployment rate, and one of our measures of bank concentration. The basic findings continue to hold. That is, measures of concentration significantly cause return on equity in the short and long run, except for the Herfindahl-Hirschman index that no longer proves significant. Moreover, the unemployment rate also significantly causes return on equity (not shown), although that effect only occurs in the short run. In other words, the unemployment rate does not cause the return on equity in the long run. Further, the return on equity does not significantly cause the concentration

measures in the short or long run. In addition, the unemployment rate does not significantly cause concentration in the short or long run (not shown).[16]

5. Conclusion

Banking structure in the U.S. underwent significant change over the past two decades. Much of that activity was initiated by competition within the banking industry. That competition added pressure to the process of deregulation that occurred over the last two decades, culminating with the Interstate Banking and Branching Act of 1994.

We examined the evidence, if any, of the relationship between several measures of bank concentration at the state level and the average performance of banks within that state. We find a robust positive correlation between bank concentration in a state and the average return on equity within that state. Moreover, the linkage appears to run from increasing bank concentration to increasing bank profitability, and not the reverse. Those observations imply that the market-power, rather than the efficient-structure, hypotheses holds for the U.S. banking industry during the last quarter of the 20th century. Thus, bank regulators need to monitor the consolidation process within the banking industry to head off the accumulation of monopoly power.

[16] Similar findings emerge from the sample that excludes 1995 to 2000. The one exception is that evidence of two-way temporal causality occurs for the Herfindahl-Hirschman measure of concentration, especially in the short-run test. See Tables 4A and 5A in the Appendix.

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Table 1: Concentration and Profitability: Top-5 Banks Share of Total Assets

	Fixed-Effect Models				Random-Effect Models			
Constant	7.0592* (6.28)	9.6601* (5.48)	17.9942* (11.13)	17.7875* (9.19)	9.2954* (7.32)	10.5518* (6.25)	20.2791* (12.87)	20.0779* (11.00)
Top5	0.2848* (13.21)	0.2643* (10.99)	0.2157* (9.72)	0.2174* (9.10)	0.2411* (12.67)	0.2303* (10.77)	0.1834* (9.76)	0.1854* (8.95)
Number of Banks		-0.0059 (-1.91)		0.0006 (0.19)		-0.0027 (-1.16)		0.0004 (0.20)
Unemployment Rate			-1.1957* (-9.15)	-1.2019* (-8.93)			-1.2979* (-10.34)	-1.3006* (-10.27)
R^2-within	0.1249	0.1275	0.1810	0.1810	0.1249	0.1269	0.1796	0.1797
R^2-between	0.1086	0.1155	0.1983	0.1970	0.1086	0.1137	0.2192	0.2176
R^2-overall	0.0904	0.0915	0.1749	0.1747	0.0904	0.0920	0.1873	0.1868

Note: The dependent variable is the average rate of return on equity (ROE) in percent in each state for 1976 to 2000. The numbers in parenthesis are t-statistics. Top5 is the percent of assets held by the largest five banks. Regressions possess 1275 observations – 51 states and the District of Columbia for 25 years (1976 to 2000).

* means statistically significant at the 1% level
** means statistically significant at the 5% level

Table 2: Concentration and Profitability: Top-10 Banks Share of Total Assets

	Fixed-Effect Models				Random-Effect Models			
Constant	2.4085 (1.63)	3.8366 (1.68)	14.6116 * (7.32)	13.3147* (5.40)	6.2352* (4.16)	6.6240* (3.20)	18.3120 * (10.12)	17.3278 * (7.89)
Top10	0.3134* (13.19)	0.3015* (10.81)	0.2319* (9.33)	0.2432* (8.73)	0.2510* (12.30)	0.2478* (10.28)	0.1849* (9.15)	0.1942* (8.33)
Number of Banks		-0.0026 (-0.82)		0.0029 (0.89)		-0.0007 (-0.30)		0.0018 (0.77)
Unemployment Rate			-1.1644* (-8.76)	-1.1882* (-8.77)			-1.2966* (-10.23)	-1.3056* (-10.25)
R^2-within	0.1245	0.1250	0.1763	0.1768	0.1245	0.1248	0.1741	0.1748
R^2-between	0.0960	0.0995	0.1721	0.1650	0.0960	0.0973	0.1989	0.1923
R^2-overall	0.0792	0.0801	0.1559	0.1543	0.0792	0.0796	0.1738	0.1719

Note: See Table 1. Top10 is the percent of assets held by the largest ten banks.

Table 3: Concentration and Profitability: Herfindahl-Hirschman Index

	Fixed-Effect Models				Random-Effect Models			
Constant	16.2967*	20.1100*	25.4834*	26.4424*	16.6858*	18.7598*	25.9906*	26.6006*
	(33.51)	(20.02)	(24.77)	(22.13)	(18.83)	(16.52)	(21.89)	(20.48)
HHI	0.0052*	0.0047*	0.0040*	0.0039*	0.0049*	0.0045*	0.0038*	0.0037*
	(12.31)	(10.71)	(9.46)	(8.96)	(12.43)	(10.89)	(9.97)	(9.24)
Number of Banks		-0.0124*		-0.0046		-0.0064*		-0.0024
		(-4.33)		(-1.57)		(-2.98)		(-1.18)
Unemployment Rate			-1.2863*	-1.2238*			-1.3330*	-1.3071*
			(-10.02)	(-9.12)			(-10.73)	(-10.37)
R^2-within	0.1102	0.1236	0.1778	0.1795	0.1102	0.1212	0.1776	0.1788
R^2-between	0.1505	0.1375	0.2746	0.2599	0.1505	0.1498	0.2816	0.2800
R^2-overall	0.1137	0.1015	0.2107	0.2033	0.1137	0.1115	0.2135	0.2130

Note: See Table 1. HHI is the Herfindahl-Hirschman index of concentration.

Table 4: Bivariate Temporal Causality Tests

	Fixed-Effect Models		Random-Effect Models	
	Short-Run F(3, 1065)	**Long-Run F(1, 1065)**	**Short-Run $\chi^2(3)$)**	**Long-Run $\chi^2(1)$**
Concentration Does Not Temporally Lead (Cause) Return on Equity				
Top5 $\Rightarrow$ ROE	13.76*	35.76*	13.42*	9.98*
Top10 $\Rightarrow$ ROE	16.26*	44.53*	11.81*	8.52*
HHI $\Rightarrow$ ROE	4.55*	10.91*	9.22**	8.05*
Return on Equity Does Not Temporally Lead (Cause) Concentration				
ROE $\Rightarrow$ Top5	0.90	0.36	2.15	0.10
ROE $\Rightarrow$ Top10	1.13	0.41	3.14	0.22
ROE $\Rightarrow$ HHI	2.98**	0.46	6.22	0.02

Note: See Tables 1, 2, and 3. The fixed- and random-effect model employ F- and χ^2-tests for temporal causality. The symbol $\Rightarrow$ means temporally causes (leads). For example, Top5 $\Rightarrow$ ROE tests whether the top-5 concentration ratio temporally causes (leads) the return on equity. The bivariate vector autoregressive system for ROE and one of the concentration measures includes three lags of each independent variable.

Table 5: Trivariate Temporal Causality Tests, including Unemployment Control

	Fixed-Effect Models		**Random-Effect Models**	
	Short-Run F(3, 1062)	**Long-Run F(1, 1062)**	**Short-Run $\chi^2(3)$**	**Long-Run $\chi^2(1)$**
Concentration Does Not Temporally Lead (Cause) Return on Equity				
Top5 ⇒ ROE	12.43*	32.19*	14.92*	11.58*
Top10 ⇒ ROE	14.67*	39.79*	13.53*	9.98*
HHI ⇒ ROE	3.86*	9.67*	10.07*	9.33*
Return on Equity Does Not Temporally Lead (Cause) Concentration				
ROE ⇒ Top5	0.57	0.08	1.42	0.15
ROE ⇒ Top10	0.69	0.23	2.21	0.46
ROE ⇒ HHI	2.53	0.00	5.73	0.53

Note: See Table 4. The trivariate vector autoregressive system for ROE, the unemployment rate, and one of the concentration measures includes three lags of each independent variable.

Appendix:

Table A1: Concentration and Profitability: Top-5 Banks Share of Total Assets

	Fixed-Effect Models				Random-Effect Models			
Constant	7.4694* (4.55)	11.8031* (4.53)	16.7175* (8.62)	18.8313* (7.06)	12.1905* (9.128)	13.2410* (7.26)	21.1695* (13.30)	21.6436* (11.08)
Top5	0.2642* (7.84)	0.2301* (6.18)	0.2395* (7.73)	0.2220* (6.17)	0.1662* (7.12)	0.1567* (5.97)	0.1546* (6.99)	0.1502* (6.04)
Number of Banks		-0.0094** (-2.14)		-0.0050 (-1.15)		-0.0021 (-0.89)		-0.0010 (-0.45)
Unemployment Rate			-1.2061* (-8.27)	-1.1843* (-8.06)			-1.2956* (-8.99)	-1.2559* (-8.95)
R^2-within	0.0628	0.0675	0.1289	0.1292	0.0628	0.0655	0.1226	0.1230
R^2-between	0.1106	0.1082	0.1801	0.1767	0.1106	0.1131	0.2111	0.2124
R^2-overall	0.0589	0.0566	0.1202	0.1162	0.0589	0.0598	0.1407	0.1410

Note: The dependent variable is the average rate of return on equity (ROE) in percent in each state for 1976 to 1994. The numbers in parenthesis are t-statistics. Top5 is the percent of assets held by the largest five banks. Regressions possess 969 observations – 51 states and the District of Columbia for 19 years (1976 to 1994).

* means statistically significant at the 1% level
** means statistically significant at the 5% level

Table A2: Concentration and Profitability: Top-10 Banks Share of Total Assets

	Fixed-Effect Models				Random-Effect Models			
Constant	3.8092 (1.77)	8.0821** (2.42)	13.8107* (5.68)	15.1929* (4.71)	10.9060* (6.94)	11.8111* (5.30)	20.1666* (11.19)	20.5462* (8.87)
Top10	0.2800* (7.66)	0.2447* (5.81)	0.2431* (6.82)	0.2252* (5.51)	0.1587* (6.64)	0.1507* (5.34)	0.1429* (6.30)	0.1395* (5.23)
Number of Banks		-0.0077 (-1.58)		-0.0040 (-0.89)		-0.0015 (-0.62)		-0.007 (-0.30)
Unemployment Rate			-1.1741* (-7.99)	-1.1602* (-7.85)			-1.2469* (-8.85)	-1.2447* (-8.82)
R^2-within	0.0602	0.0630	0.1214	0.1221	0.0602	0.0618	0.1148	0.1150
R^2-between	0.0951	0.0952	0.1567	0.1552	0.0951	0.0968	0.1938	0.1945
R^2-overall	0.0502	0.0494	0.1054	0.1030	0.0502	0.0508	0.1306	0.1307

Note: See Table A1. Top10 is the percent of assets held by the largest ten banks.

Table A3: Concentration and Profitability: Herfindahl-Hirschmann Index

	Fixed-Effect Models				Random-Effect Models			
Constant	13.2155* (17.60)	16.6888* (10.48)	21.7417* (17.73)	23.3665* (13.48)	15.3226* (17.93)	15.6973* (12.98)	23.9565* (19.47)	23.9038* (16.54)
HHI	0.0080* (9.82)	0.0073* (8.60)	0.0076* (9.70)	0.0072* (8.84)	0.0056* (9.35)	0.0055* (8.44)	0.0053* (9.43)	0.0053* (8.70)
Number of Banks		-0.0102** (-2.47)		-0.0053 (-1.33)		-0.0010 (-0.48)		0.0001 (0.04)
Unemployment Rate			-1.2265* (-8.61)	-1.1988* (-8.33)			-1.2595* (-9.18)	-1.2594* (-9.16)
R^2-within	0.0951	0.1011	0.1628	0.1644	0.0951	0.0967	0.1576	0.1577
R^2-between	0.1869	0.1656	0.2589	0.2446	0.1869	0.1864	0.2814	0.2811
R^2-overall	0.1011	0.0892	0.1649	0.1550	0.1011	0.1008	0.1803	0.1802

Note: See Table A1. HHI is the Herfindahl-Hirschmann index of concentration.

Table A4: Bivariate Temporal Causality Tests

	Fixed-Effect Models		Random-Effect Models	
	Short-Run F(3, 759)	**Long-Run F(1, 759)**	**Short-Run $\chi^2(3)$**	**Long-Run $\chi^2(1)$**
Concentration Does Not Temporally Lead (Cause) Return on Equity				
Top5 ⇒ ROE	11.02*	24.47*	15.99*	8.87*
Top10 ⇒ ROE	12.07*	28.76*	11.74*	6.13**
HHI ⇒ ROE	6.95*	18.39*	17.52*	13.79*
Return on Equity Does Not Temporally Lead (Cause) Concentration				
ROE ⇒ Top5	0.80	0.66	2.19	0.74
ROE ⇒ Top10	1.12	0.09	3.70	0.37
ROE ⇒ HHI	3.93*	2.67	8.32**	4.08**

Note: See Tables A1, A2, and A3. The fixed- and random-effect model employ F- and χ^2-tests for temporal causality. The symbol ⇒ means temporally causes (leads). For example, Top5 ⇒ ROE tests whether the top-5 concentration ratio temporally causes (leads) the return on equity. The bivariate vector autoregressive system for ROE and one of the concentration measures includes three lags of each independent variable.

Table A5: Trivariate Temporal Causality Tests, including Unemployment Control

	Fixed-Effect Models		**Random-Effect Models**	
	Short-Run F(3, 756)	**Long-Run F(1, 756)**	**Short-Run $\chi^2(3)$**	**Long-Run $\chi^2(1)$**
Concentration Does Not Temporally Lead (Cause) Return on Equity				
Top5 ⇒ ROE	10.73*	22.87*	16.52*	9.55*
Top10 ⇒ ROE	11.40*	25.74*	12.22*	6.67*
HHI ⇒ ROE	7.09*	18.36*	18.10*	14.52*
Return on Equity Does Not Temporally Lead (Cause) Concentration				
ROE ⇒ Top5	0.57	0.15	0.76	0.18
ROE ⇒ Top10	0.75	0.02	1.62	0.03
ROE ⇒ HHI	4.09*	1.37	9.03**	3.58

Note: See Table A4. The trivariate vector autoregressive system for ROE, the unemployment rate, and one of the concentration measures includes three lags of each independent variable.