

# Competitive analysis in banking: Appraisal of the methodologies

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## Introduction and summary

Over the last 20 years, the U.S. banking industry has experienced significant structural changes as the result of an intense process of consolidation. From 1975 to 1997, the number of commercial banks decreased by about 35 percent, from 14,318 to 9,215. Since the early 1980s, there have been an average of more than 400 mergers per year (see Avery et al., 1997, and Simmons and Stavins, 1998). The relaxation of intrastate branching restrictions, effective to differing degrees in all states by 1992, and the passage in 1994 of the Riegle–Neal Interstate Banking and Branching Efficiency Act, which allows bank holding companies to acquire banks in any state and, since June 1, 1997, to open interstate branches, is certainly accelerating the process of consolidation.

These significant changes raise important policy concerns. On the one hand, one could argue that banks are merging to fully exploit potential economies of scale and/or scope. The possible improvements in efficiency may translate into *welfare* gains for the economy, to the extent that customers pay lower prices for banks' services or are able to obtain higher quality services or services that could not have been offered before.<sup>1</sup> On the other hand, from the point of view of public policy it is equally important to focus on the effect of this restructuring process on the competitive conditions of the banking industry. Do banks gain market power from merging? If so, they will be able to charge higher than competitive prices for their products, thus inflicting welfare costs that could more than offset any presumed benefit associated with mergers.

In this article, I analyze competition in the banking industry, highlighting a very fundamental issue: How do we measure market power? Do regulators rely on accurate and effective procedures to evaluate the competitive effects of a merger?

The U.S. Department of Justice, the Federal Reserve System, the Federal Deposit Insurance Corporation (FDIC), and the Office of the Comptroller of the Currency (OCC) enforce the antitrust laws in banking. The procedures to evaluate the competitive impact of a proposed merger may differ in some details among the agencies, but they all share the same approach, based on *structural analysis* of the banking market affected by the merger. The basic guideline, established by the Justice Department, requires the evaluation of the concentration of deposit market shares held by banks operating in the affected market. The importance of market concentration finds its theoretical justification in the so-called structure–conduct–performance paradigm (Bain, 1951), which postulates that fewer and larger firms (higher concentration) are more likely to engage in anticompetitive conduct. For example, a small number of large firms may be able to cooperate and act as a monopoly (*cartel*). Alternatively, one or more firms together may be large enough to set higher than competitive prices (acting as a *dominant firm*), while the other (smaller) firms would act as a *competitive fringe*, following the dominant firm's behavior.

The most common measure of concentration, and the one used by regulators, is the Herfindahl–Hirschman Index (HHI), which is defined as the sum of the squared market shares of all banks in the market (box 1 explains how the index is calculated).<sup>2</sup> According to the current screening guidelines, if the post-merger market HHI is lower than 1,800 points, *and* the increase in the index from the pre-merger situation is

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less than 200 points, the merger is presumed to have no anticompetitive effects and is approved by the regulators. Should those threshold values be exceeded, the regulators will check for the existence of potential *mitigating factors* that would make it unlikely that the merger could result in anticompetitive behavior. The regulators also seek to identify those extreme cases in which the potential welfare loss from the exercise of market power would be smaller than the loss produced by maintaining the status quo (for example, the merger might prevent the failure of one of the parties involved, thus preserving the stability of the market).<sup>3</sup> If the mitigating factors are not enough to justify the merger, the regulators may require the divestiture of some branches and offices, in order to bring the concentration indicator closer to or below the threshold level. If divestiture would not accomplish this goal, the merger application is denied.<sup>4</sup> If the merger does not violate the 1,800/200 rule,<sup>5</sup> the application is approved without further investigation.

Over the years, very few mergers have been denied. However, this fact should not lead one to conclude that the rules are not sufficiently stringent. The official statistics do not show attempts to file merger applications that were abandoned because of

a voluntary decision of the banks involved or informal dissuasion by the regulators.

Does the ongoing merger and consolidation process represent a real competitive threat? A survey of local markets shows that concentration is a widespread characteristic of the banking industry. For example, in 1994, about 40 percent of metropolitan statistical areas (MSAs) had HHIs greater than 1,800 (Rhoades, 1995b). If indeed high concentration implies noncompetitive conduct, then policy concerns about the welfare effects of future mergers may be justified.

First, I review the appropriateness of the use of the HHI as a main screening factor in merger analysis. I examine the theoretical foundations of the market concentration–market power relationship and how focusing on market structure to infer firms’ conduct may lead to ambiguous or even misleading conclusions about the potential effects of a merger.

Next, I survey the state of the art of the empirical literature. If there are consistent and convincing empirical results confirming the existence of the market concentration–market power relationship, then it may be appropriate to use it in policy analysis, even in the absence of a solid theoretical explanation. While

BOX 1

Calculation of the Herfindahl-Hirschman Index (HHI)

The HHI formula is

$$HHI = \sum_{i=1}^n MS_i^2,$$

where  $MS_i$  is the market share of bank  $i$  and  $n$  is the number of banks in the market.

Suppose a market has five banks. The share of total deposits of each bank is as follows:

	<b>Deposit market share</b>
Bank 1	30
Bank 2	25
Bank 3	21
Bank 4	16
Bank 5	8

The  $HHI = 30^2 + 25^2 + 21^2 + 16^2 + 8^2 = 2,286$ . Suppose that banks 3 and 5 merge. After the merger, the  $HHI = 30^2 + 29^2 + 25^2 + 16^2 = 2,622$ , with a post-merger increase  $\Delta HHI = 336$ . In antitrust

evaluation this merger may be rejected, because it violates the 1,800/200 rule.

By construction, the HHI has an upper value of 10,000, in the case of a monopolist firm with 100 percent share of the market, and tends to zero in the case of a large number of firms with very small market shares.

The HHI synthesizes information on both the distribution of market shares and the number of banks in the market. With some manipulation it could be rewritten as

$$HHI = \frac{V^2 + 1}{n},$$

where  $V$  is the coefficient of variation of deposit market shares, and  $n$  is the number of firms in the market. This feature of the HHI makes it more popular than other concentration indicators, such as the *n-firm ratio*, calculated as the sum of the market shares of the  $n$  largest firms in the market, where  $n$  is usually 3 or 4.

there have been important contributions confirming a positive and significant relationship between market concentration and the exercise of market power, other recent work has cast doubt on the overall empirical strength of such a relationship.

I then describe an alternative methodology of competitive analysis that does not infer banks' conduct through the analysis of market structure. This methodology recognizes that firms' behavior differs depending on whether they operate in a perfectly competitive market, a monopolistic market, or any other prevalent market structure. I survey the applications of this methodology, which is based on the estimation of a direct indicator of firms' behavior, for the banking industry.

Finally, I present some results of a specific empirical application of this methodology to the Italian banking industry. The analysis of Italy is relevant because the Italian banking industry has experienced a similar pattern of structural and regulatory changes as U.S. banking. In particular, as the result of an ongoing process of consolidation, the Italian HHI has been steadily increasing. The results of my empirical analysis indicate a steady convergence toward competitive conditions, providing evidence that changes in market concentration may not always provide correct information about the exercise of market power.

### Theory behind the Herfindahl-Hirschman Index

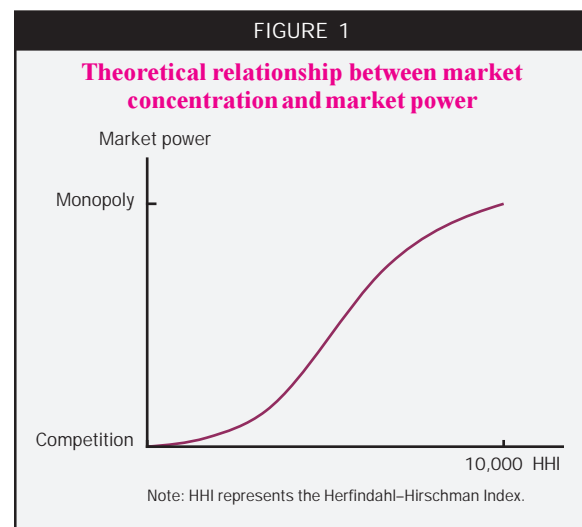
As discussed above, the use of concentration ratios to evaluate competitive conditions relies on the theoretical predictions of the structure-conduct-performance paradigm. According to this paradigm, structure affects the conduct of firms, which ultimately determines their performance. Concentration of market shares will facilitate the adoption of collusive conduct and, ultimately, the setting of prices departing from the perfectly competitive benchmark. In a perfectly competitive market, firms are considered too small to have an individual impact on the price of the good they produce. From the point of view of social welfare, perfect competition represents an ideal benchmark, since consumers (in this case bank customers) pay the lowest possible price for the product they demand. Any situation in which firms command some degree of market power and are therefore able to set higher than competitive prices implies a social cost in terms of welfare loss for consumers.

The structure-conduct-performance paradigm predicts that there is an increasing relationship between the level of market concentration and market power. Some authors are more precise in stating that

the relationship, while it is increasing, may not be linear. One would expect that at low levels of concentration, conduct is close to competitive, and an increase in concentration would generate a substantial increase in market power. At high levels of concentration, conduct is already very far from the competitive benchmark, and an additional increase would not increase market power very much. Given this argument, the market concentration-market power relationship should be S-shaped, as shown in figure 1 (Carlton and Perloff, 1989).

Is it possible to derive an optimal behavior rule from a model of industrial organization theory that predicts an increasing relationship between market concentration and market power? Can we rely on such a model to find a theoretical justification for, say, the 1,800/200 rule? The answer is yes, but only if one makes strong, restrictive assumptions about firms' behavior, such as assuming that firms behave as *Cournot oligopolists*. Under Cournot conduct, a firm makes the simplistic assumption that all other firms have no reaction to a change in its behavior (see the technical appendix for the analytical derivation of this result). However, in more general (and plausible) theoretical models that allow for active interactions among firms, the market concentration-market power relationship is less obvious.

Thus, it seems that we cannot rely too much on theory to justify the postulated market concentration-market power relationship. Before surveying the approach taken in the profession, which has been to turn to a direct empirical corroboration of the postulated relationship, I present some simple numerical examples showing that, in the absence of a complete theory that can explain the market concentration-market



power relationship, it is possible to generate ambiguous or even incorrect predictions about the effects of a structural change on competition.

### Numerical examples

These examples demonstrate the following two assertions: First, even when the 1,800/200 rule is not violated, a merger may generate anticompetitive conduct. Second, a merger may be procompetitive even when the 1,800/200 rule is violated.

In the first two examples, the basic guidelines are not violated. However, the mergers may generate the right conditions for monopoly power, not necessarily exercised only by the banks involved in the merger. Table 1 summarizes the examples.

In a pre-merger market with 20 banks, each with a 5 percent market share (see table 1, example 1), the HHI ( $5^2 + 5^2 + \dots + 5^2 = 500$ ) characterizes a market with a relatively large number of banks with equal and small market shares and is presumably associated with a low likelihood of anticompetitive behavior. Suppose five of the banks are involved in a series of mergers. When all the mergers are completed, the market has one bank with a 25 percent market share and 15 banks with 5 percent each. The post-merger HHI of 1,000 would still be considered (borderline) unconcentrated.<sup>6</sup> However, the newly created bank, with a 25 percent market share, may be able to act as a *dominant firm*, setting noncompetitive prices, with the remaining 15

banks behaving as a *competitive fringe*, adjusting to the noncompetitive choices of the dominant firm.

In the second example, the pre-merger market has 15 banks, two with 15 percent market shares, one with 10 percent, and 12 with 5 percent (see table 1, example 2). The two larger banks,  $B_1$  and  $B_2$ , taken separately, may still be too small to behave as dominant firms. In addition, tacit or explicit collusion between them to act together as a dominant firm may still be unlikely, given the fact that the combined market share may not generate the market power and extra profits necessary to offset the costs associated with collusion.<sup>7</sup> The HHI of 800 may therefore be correct in characterizing a competitive market.

Suppose banks  $B_3$  and  $B_{15}$  merge. The post-merger structure now has three banks with a 15 percent market share each and 11 banks with 5 percent each. The post-merger HHI is now 950. As in the first example, according to the guidelines the market would still be considered unconcentrated. However, the three major banks may now be able to coordinate (explicitly or tacitly) their action, thus producing adverse competitive conditions. (Note also that the two larger banks in the pre-merger market are benefiting from a merger that did not directly involve them).

The third example describes a market in which some degree of collusive behavior might have been observed prior to the merger (see table 1, example 3). The merger could create conditions under which the stable collusive agreement would break down, thus restoring market competition. However, since the basic guidelines are violated, the merger could be rejected and the exercise of market power preserved.

The pre-merger market has seven banks, three with 20 percent market shares, two with 15 percent shares, and two with 5 percent shares. The HHI of 1,700, classifying the market as moderately concentrated, may not fully account for a situation in which the three largest banks,  $B_1$ ,  $B_2$ , and  $B_3$ , may be able to collude. In the event of a merger between banks  $B_4$  and  $B_5$ , the post-merger market would have six banks, one with a 30 percent market share, three with 20 percent each, and two with 5 percent each. The post-merger HHI of 2,150 identifies this as a highly concentrated market. In addition, since the change in the HHI would be more than 200 points, there are grounds for the regulator to reject the merger application. However, the stability of a

TABLE 1

#### Examples of pre- and post-merger markets

<b>Example 1</b>							
Pre-merger market (20 banks)							
Bank	$B_1$	$B_2$	$B_3$	...	$B_{20}$		
Market share (%)	5	5	5	...	5		
Post-merger market (16 banks)							
Bank	$B_1$	$B_2$	$B_3$	...	$B_{16}$		
Market share (%)	25	5	5	...	5		
<b>Example 2</b>							
Pre-merger market (15 banks)							
Bank	$B_1$	$B_2$	$B_3$	$B_4$	...	$B_{15}$	
Market share (%)	15	15	10	5	...	5	
Post-merger market (14 banks)							
Bank	$B_1$	$B_2$	$B_3$	$B_4$	...	$B_{14}$	
Market share (%)	15	15	15	5	...	5	
<b>Example 3</b>							
Pre-merger market (7 banks)							
Bank	$B_1$	$B_2$	$B_3$	$B_4$	$B_5$	$B_6$	$B_7$
Market share (%)	20	20	20	15	15	5	5
Post-merger market (6 banks)							
Bank	$B_4$	$B_1$	$B_2$	$B_3$	$B_6$	$B_7$	
Market share (%)	30	20	20	20	5	5	

collusive agreement is known to decrease with the number of participants. In the new market structure, with four large players, the collusion might break down. In that case, the merger would actually be procompetitive.

In considering whether to reject the merger application, the regulator may impose some degree of divestiture on the banks involved in the mergers. Ironically, banks  $B_1$ ,  $B_2$ , and  $B_3$ , which were not involved in the merger, could benefit in this case, as the post-divestiture  $B_4$  may not be strong enough to undermine the stability of their pre-merger collusive agreement.

The market dynamics described in these numerical examples are all hypothetical. My point is that whether a merger will generate (undetected) anticompetitive conditions or actually improve competition *cannot* be determined unambiguously just by looking at market structure. Banks' behavior can only be measured accurately through direct empirical analysis.

### Empirical evidence

The empirical evidence for the existence of the market concentration–market power relationship is mixed. Some influential papers have suggested a positive relationship between concentration and the degree of market power. For example, Berger and Hannan (1989) analyze a cross-section of banking markets in 1983–85. After controlling for various factors affecting price-setting behavior, the authors find that deposit rates are significantly lower in the most concentrated markets.

Other work compares the time-series behavior of the deposit interest rate (and/or the loan rate) with the benchmark money market rate, which is not controlled by the banks. If banks have market power, they will, for example, quickly lower the deposit rate when the money market rate decreases, but the deposit rate will be sluggish when the money market rate increases. Conversely, in perfect competition one should expect quick reactivity in both cases. Hannan and Berger (1991) and Neumark and Sharpe (1992) find evidence of deposit rate rigidity and, thus, evidence of market power in the U.S. banking industry. Importantly, they find a higher level of rigidity in markets with higher HHIs.

However, recent research casts doubt on the market concentration–market power relationship. Reviewing Berger and Hannan's (1989) results, Jackson (1992b) suggests that the market concentration–market power relationship may not be monotonic. He finds that such a relationship already holds at low levels of concentration, but in markets with middle levels of concentration the relationship vanishes, and it actually changes sign in highly concentrated markets (although this is a less robust result). In other words, at higher levels of concentration, an increase in concentration may

imply *less* anticompetitive behavior, as suggested in example 3 of table 1.

In another work focusing on the rigidity of deposit rates, Jackson (1997) presents additional evidence that the market concentration–market power relationship may not be monotonic. He finds that while it is true that at high levels of concentration price rigidity increases, this is also the case at low levels of concentration. This suggests a U-shaped relationship between market power and market concentration which is not consistent with the structure–conduct–performance hypothesis.

Similarly, Rhoades (1995a) observes that structural characteristics may vary widely for markets exhibiting similar HHI levels. In particular, the market share distribution may differ substantially. As shown in example 1 above, firms' conduct may be very different depending on market share distribution. Rhoades shows that market share inequality and the number of firms in the market have an effect on banks' profitability that is independent of the HHI, despite the fact that (as shown in box 1) the HHI incorporates information on both market share variability and the number of firms. Finally, in an analysis similar to Berger and Hannan's (1989), Hannan (1997) extends Rhoades's (1995a) contribution by analyzing the impact of these two factors on deposit rate levels. His results for a cross-section of banking markets using November 1993 data show, first, that the HHI was not significant in explaining deposit rates and, second, that it was not able to take into account the separate importance of market share inequality and the number of firms.

Thus, a lack of strong theoretical foundations and mixed empirical evidence motivate the search for alternative methodologies to investigate firms' competitive behavior.

### Oligopoly theory and the measurement of market power

Methodologies in the “new empirical industrial organization” literature analyze firms' conduct directly, instead of relying on observation of the market structure.<sup>8</sup> Following this approach, the relationship between theory and firms' conduct becomes unambiguous. For instance, as mentioned earlier, if banks are behaving as Cournot oligopolists, the market concentration–market power relationship would be theoretically grounded and the use of the HHI to infer firms' conduct would be appropriate. This alternative methodology allows us to test whether indeed banks behave as Cournot oligopolists. However, the methodology is flexible enough to allow us to test for behavior that could be consistent with alternative models of



oligopoly theory. In such a case the market concentration–market power relationship would not be as clearly identified as in the Cournot case, but one would still be able to quantify the departure from perfect competition and, hence, to assess the degree of market power exercised in the industry.

The technical appendix provides details of the methodology. The following example illustrates the intuition. Suppose there is an exogenous increase in the demand for bank loans. In response, banks will take into account the cost they would incur in increasing the quantity of loans, the reactivity of demand itself to possible increases in the loan rate, and the expected reaction of the other banks in the market to their chosen course of action. In particular, the degree of interaction with the other banks in the market could differ substantially, depending on whether banks are in perfect competition with each other or enjoy some degree of market power. More precisely, the parameter of banks' interaction should be equal to 0 if the market is perfectly competitive, equal to 1 if it is monopolistic, and should take intermediate values between 0 and 1 if banks are neither perfectly competitive or monopolistic but still exercise a positive degree of market power. Using appropriate econometric modeling techniques, one can estimate this parameter of interaction and, therefore, a quantifiable measure of market power.

The advantage of this approach is that it is rigorously based on theory and does not require indirect (and perhaps ambiguous) inferences about market power through measures of market concentration. The major limitation of the approach is that it requires detailed information, mainly on cost and demand conditions at the firm level.

### Applications to the banking industry

Spiller and Favaro (1984) estimate the parameter of banks' interaction for the Uruguayan banking industry in a period characterized by a significant relaxation of entry regulations. They apply a refinement of the methodology proposed by Gollop and Roberts (1979) to see whether different groups of banks have different reactions to other groups' change in behavior. They reject Cournot conduct and find evidence of dominant firm–competitive fringe behavior, with a significant degree of oligopoly power, although this is substantially reduced after deregulation. Gelfand and Spiller (1987) extend the analysis of Uruguayan banks, treating the banks as multiproduct firms, the products being loans in the domestic currency and in U.S. dollars. They find evidence of noncompetitive behavior and, in particular, behavior consistent with *mutual forbearance*, whereby firms avoid changing

behavior in one market fearing retaliation in another market, and with *spoiling*, whereby firms adopt predatory strategies. Applying the methodology to the Norwegian banking industry, Berg and Kim (1994) find that Cournot behavior is strongly rejected by the data and that instead banks behave as if they expect retaliation from their competitors in response to a change in their own behavior. Berg and Kim (1996) also investigate Norwegian banks as multiproduct firms, distinguishing between the retail and corporate banking markets. They find banks' degree of oligopoly power to be relatively high in the retail market and lower in the corporate market. Interestingly, the Herfindahl indicators for the two markets analyzed suggest opposite findings. Shaffer (1989), using aggregate data for the U.S. banking industry, finds no evidence of oligopoly power. Similarly, in a study of Canadian banking, Shaffer (1993a) finds that despite structural and regulatory changes, Canadian banks operate in a market exhibiting perfect competition. Shaffer and Di Salvo (1994) focus on a local market in Pennsylvania with only two banks. They find that banks' conduct is imperfectly competitive, but closer to perfect competition than one would expect, given the very high degree of concentration in that market.

### Measuring market power: Results from an application to the Italian banking industry

Next, I present some results from an application of the methodology outlined above to the Italian banking industry. The remainder of the section is based on Angelini and Cetorelli (1998).

As mentioned in the introduction, there are at least two reasons the evolution of the Italian banking industry is of interest. First, the Italian banking industry is experiencing a similar pattern of regulatory and structural changes as that observed in the U.S. In the late 1980s, the requirement that Italian banks obtain a specific authorization from the central bank to open an additional branch was eliminated. Consequently, from 1983 to 1993 the number of branches increased by 67 percent. At the same time, mainly based on the anticipated opening of Italy's national borders to international competition, widespread merger activity reduced the number of banks by more than 10 percent, to a total of approximately 900. It is not clear *a priori* whether such changes have actually enhanced competition. Second, the results for Italy highlight the possibility that changes in market concentration may provide misleading information on the exercise of market power.

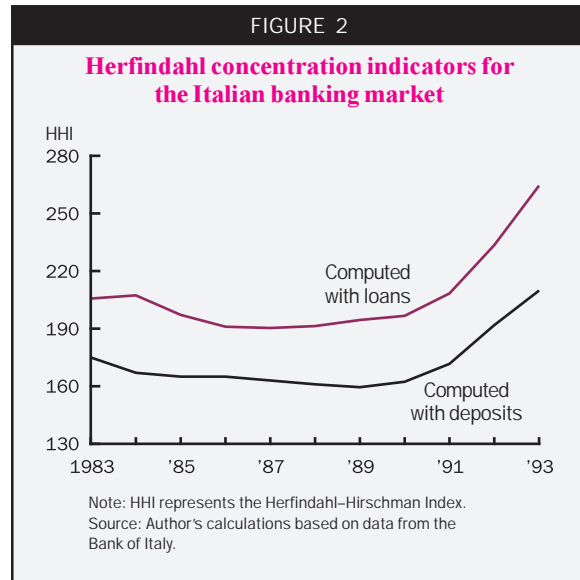
To determine an average indicator of banks' interaction, Angelini and Cetorelli (1998) analyze the market for commercial loans in 1983–93, pooling data

on all individual banking institutions, in substance treating the market for commercial loans as having a national dimension. It is usually argued that, especially for wholesale loans, the market boundaries are indeed very wide. Given that Italy is about as large as a mid-size U.S. state, using such a broad market definition seems appropriate. Also, performing the analysis at the national level increases the potential for finding evidence of perfect competition. This is true at least in terms of the structure–conduct–performance approach, since, as we will see below, market concentration is very low at the national level. With a possible bias in the study toward a finding of competition, therefore, evidence of noncompetitive behavior would be a strong result.

Angelini and Cetorelli (1998) make the following observations about the level of concentration of the Italian banking industry. First, the HHI, calculated on both deposits and loans, remained practically unchanged in the first part of the sample period, but increased noticeably after 1990, clearly due to the wave of bank mergers mentioned above. Second, in absolute terms the HHI remains very low, going from about 200 to 260 points over the entire period. Figure 2 plots the HHI time series for both deposits and loans. Following the predictions of the structure–conduct–performance paradigm, these two observations would imply that, given the extremely low level of concentration, the Italian banking industry should exhibit a very high degree of competition over the entire sample period, but with gradual movement toward conditions more appropriate to the exercise of market power.

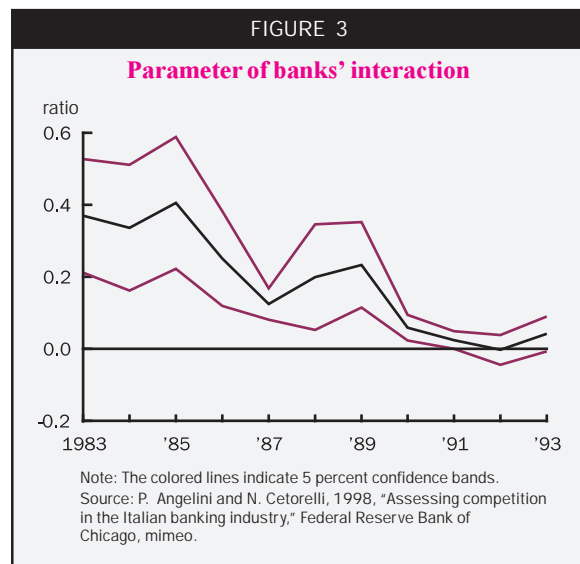
In fact, the results of the econometric estimation contradict both predictions of the structure–conduct–performance paradigm. Figure 3 shows the estimates of the parameter of banks’ interaction for each year between 1983 and 1993, a period including years before and after the regulatory changes. As explained earlier, the parameter should take values between 0 and 1, with 0 representing the perfectly competitive benchmark and 1 the monopolistic benchmark. However, the results show the parameter is significantly different from 0 (and from 1) for almost the entire sample period, thus rejecting the hypothesis that the Italian banking industry is perfectly competitive (as well as the hypothesis that it is a perfect monopoly). This finding contradicts the inference one would draw from the HHI. Indeed, given the very low level of concentration, one might expect the market for commercial loans at the national level to be very competitive.

A further observation is that the parameter is well above 0 in the initial part of the sample, prior to deregulation, and shows an approximately steady



decline throughout the rest of the sample period. This can be seen as evidence that the regulatory and structural changes have indeed enhanced the overall competitiveness of the banking industry. Finally, the parameter approaches 0, suggesting the presence of perfectly competitive conditions, toward the end of the period. This represents a second element of contradiction with the information in the HHI, which is increasing in the final years of the sample period.

In addition to the estimation of the parameter of interaction, Angelini and Cetorelli (1998) estimate a parameter measuring the elasticity of demand for commercial loans. As mentioned earlier, in deciding on behavior, banks have to take into account not only the



expected reaction of other banks but also the reaction of customers. Whether the market for loans exhibits a high or low elasticity to changes in the loan rate is crucial to banks' ability to exercise market power and affect profits. The intuition is simple. Suppose the parameter of interaction is very high, close to 1, approximating ideal conditions for the exercise of market power. Banks would attempt to keep a high loan rate, or to increase it, to maximize their profits. However, if market demand elasticity is also high, borrowers are likely to reduce substantially their demand for loans in the case of a price increase. In such a case, banks will be constrained in their ability to profit from their market power. The opposite would be true in the case of a rigid demand schedule.

This consideration is important, therefore, if we are interested in exploring the actual welfare cost of market power, in terms of how high the loan rate is relative to what it would be under perfect competition. To obtain a quantifiable measure of this, Angelini and Cetorelli (1998) compute the ratio of the parameter of banks' interaction and the parameter measuring demand elasticity. When this ratio is close to 0, it means that the market exhibits competitive conditions, regardless of banks' potential ability to exercise market power. Figure 4 reports estimates for this ratio for every year in the sample period. Between 1984 and 1986, interest rates on loans charged by banks were about 2 percentage points above the level that would have been charged under competitive conditions (interest rates on loans averaged around 21 percent). This gap declined to about 1 percentage point in 1987–89, then dropped to practically 0 at the beginning of the new decade. This provides evidence that the Italian banking industry

has changed substantially as a result of the process of deregulation and consolidation that began in the late 1980s.

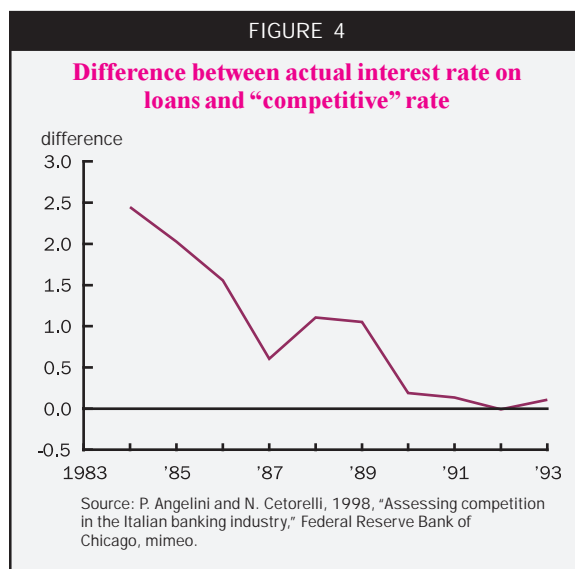
## Conclusion

This article has presented an overview of the methodologies used in competitive analysis of the banking industry. Given the ongoing process of consolidation in the U.S. banking industry, properly identifying the conditions for the exercise of banks' market power is highly relevant for policy analysis.

I have briefly outlined the antitrust analysis procedure currently followed by the regulators. Drawing on the existing literature, I have highlighted some challenges to the theoretical foundations of the current approach, which is based on the identification of an increasing, monotonic relationship between market concentration and market power. Only under rather strong, restrictive assumptions about the behavior of banking firms is this relationship identifiable. As shown in the numerical examples, relying on concentration measures alone to infer industry conduct may lead to possibly incorrect conclusions. The empirical evidence on the existence of the market concentration–market power relationship is rather mixed, in light of several recent works that cast doubt on the robustness of such a relationship.

An alternative methodology for the identification of parameters of firms' conduct and the degree of market power, which does not rely on indirect inferences of market structure analysis, requires an econometric estimation of market demand and supply conditions. The testable implications associated with this approach allow us to unambiguously identify firms' conduct. The results from an empirical application of this methodology to the Italian banking industry provide evidence that contradicts the inferences of the structure–conduct–performance approach.

Adopting this alternative methodology to identify the parameter of banks' interaction brings a higher rigor to the antitrust analysis, implicit in the econometric exercise required to extract information from industry data. This is, however, also its principal shortcoming, in terms of the need for more detailed data and the greater difficulty associated with the implementation and interpretation of the econometric work. Conversely, the main advantage of the current approach to competitive analysis is that HHI indicators are relatively easy to compute and allow the regulators to formulate objective statements (for example, setting the 1,800/200 guideline) and deliver opinions that are less subject to arbitrary judgements. Nonetheless, it is important to recognize the potential





shortcomings of the current approach and to test for accountability when developments in economic research provide the appropriate tools.

For example, the alternative methodology presented in this article could be applied to markets in which mergers have been approved to analyze banks' conduct before and after the change in market structure.<sup>9</sup> In addition to an "after the fact" analysis, the

methodology could be used routinely to overview market conditions and to provide *ex ante* information that could be used by regulators when a merger application is filed, perhaps to resolve potential ambiguities associated with mere observation of market structure. In this way, the methodology could be adopted to complement the current procedure for antitrust analysis.

## TECHNICAL APPENDIX

### Details of the methodology

#### Estimating market power

The basic elements of the methodology can be illustrated as follows.<sup>1</sup> In an industry producing a single good, let  $p$  be the market price of product  $y$  and let  $y_j$  be the quantity produced by firm  $j$ ,  $j = 1, \dots, m$ , and  $\sum_j y_j = y$ . Let the demand function, written in inverse form, be  $p = p(y, z)$ , where  $z$  is a vector of exogenous variables affecting demand. In addition, let  $C(y_j, \omega_j)$  be the cost function for firm  $j$ , where  $\omega_j$  is the vector of the prices of the factors of production employed by firm  $j$ .

Firms in this industry behave as profit maximizers. The profit maximization problem for firm  $j$  is written as

$$1) \quad \text{Max}_{y_j} p(y, z) y_j - C(y_j, \omega_j).$$

If firms were in perfect competition with each other, they would set their optimal quantities at the point where the marginal cost of production would equal the market price, that is,

$$2) \quad p = C'(y_j, \omega_j),$$

where  $C'(y_j, \omega_j)$  is the marginal cost of firm  $j$ .

At the opposite extreme, suppose there is only one firm in the industry, operating as a monopolist. In such a case, we know that the firm would set quantities to a level where marginal revenue equals marginal cost, or

$$3) \quad p = C'(y, \omega) - \frac{dp}{dy} y,$$

where  $p + \frac{dp}{dy} y$  is the monopolist marginal revenue  $\left( \frac{dp}{dy} y < 0 \right)$ . In intermediate oligopolistic structures, with  $m$  firms operating in the market, conduct would be summarized by the general expression

$$4) \quad p = C'(y_j, \omega_j) - \frac{dp}{dy} y_j \theta_j,$$

where the parameter  $\theta_j$  is an index of oligopoly conduct, quantifying the departure from the competitive benchmark. Equation 4 is a very general expression embedding various models of oligopoly behavior, which can be estimated econometrically. To appreciate its generality, it is perhaps convenient to interpret  $\theta_j$  as a parameter measuring the "conjectured" or "perceived" response of the entire industry to a change in quantity operated by firm  $j$ . Solve the maximization problem in equation 1 in more extensive form as

$$5) \quad p + \frac{\partial p}{\partial y} \frac{\partial y}{\partial y_j} y_j - C'(y_j, \omega_j) = 0.$$

Multiply and divide the second term of equation 5 by  $y$ . Then, rearranging terms, the equation can be rewritten as

$$6) \quad p = C'(y_j, \omega_j) - \frac{\theta_j}{\tilde{\epsilon}},$$

where

$$7) \quad \tilde{\epsilon} \equiv \frac{\partial y}{\partial p} \frac{1}{y}, \tilde{\epsilon} < 0$$

is the semi-elasticity of demand and

$$8) \quad \theta_j \equiv \frac{\partial y}{\partial y_j} \frac{y_j}{y}$$

is the so-called conjectural elasticity, that is, the percentage variation in aggregate output due to firm  $j$ 's

change in  $y_j$ . It should be clear that one does not need to impose any *a priori* restriction on  $\theta_j$ , that is, any behavioral model is *a priori* plausible, and the more appropriate one can be tested and identified econometrically. For example, if firms were Cournot oligopolists, then  $\frac{\partial y}{\partial y_j} = 1$ . Recall that under Cournot behavior, firm  $j$  expects that all other firms will not adjust their quantities to a change in  $y_j$ . Therefore, since  $y = \sum_j y_j$  incorporates firm  $j$  quantity, the total variation in output to a change in  $y_j$  must equal unity. Thus, under Cournot,  $\theta_j$  would reduce to the market share of firm  $j$ .

If firms were instead in perfect competition, then  $\frac{\partial y}{\partial y_j} = 0$ , hence  $\theta_j = 0$ . In the case of monopoly,  $\frac{\partial y}{\partial y_j} = 1$  and  $y_j = y$ , hence  $\theta_j = 1$ . Therefore, the convenient feature of this approach is that it specifies well-defined boundaries in terms of industry equilibrium conditions (perfect competition at one end and monopoly at the other), within which it is possible to identify the actual underlying characteristics of firms' conduct.

Given the generality of the methodology, one can also test whether  $\theta_h \neq \theta_l$ , where  $h = 1, \dots, l$  and  $i = 1, \dots, n$  and  $l + n = m$ . This would allow us to test, for example, whether firms behave according to dominant firm or leader-followers models.

#### **Analytical derivation of the market concentration–market power relationship**

We can also see now under what behavioral restrictions it is possible to identify a relationship between market concentration and market power.<sup>2</sup> Define the degree of market power of firm  $j$  as

$$9) \quad \alpha_j = \frac{p - C'(y_j, \omega_j)}{p} = \frac{\theta_j}{\varepsilon},$$

where  $\varepsilon \equiv \frac{\partial y}{\partial p} \frac{p}{y}$  ( $\varepsilon < 0$ ) is the elasticity of demand.

Now define the degree of market power of the industry as a firm average, weighted by firms' relative size,

$$10) \quad \alpha = \sum_j \left[ \frac{p - C'(y_j, \omega_j)}{p} \right] \frac{y_j}{y} = \sum_j \frac{\theta_j}{\varepsilon} \frac{y_j}{y}.$$

Given the definition of  $\theta_j$  we can rewrite this last expression as

$$11) \quad \alpha = \sum_j \frac{1}{\varepsilon} \frac{\partial y}{\partial y_j} \left( \frac{y_j}{y} \right)^2.$$

Assume now that all firms form the same, identical conjecture about how the rest of the industry would react to a change in their own quantities. In addition, assume that these identical conjectures will also stay the same over time and over changes in market structure (for example, distribution of market shares and number of firms). Under these conditions,  $\frac{\partial y}{\partial y_j} = \gamma, \forall j$ , where  $\gamma$  is a given constant.

Consequently

$$12) \quad \alpha = \frac{1}{\varepsilon} \gamma HHI.$$

The Cournot model, where  $\gamma = 1$ , is an example of a model that would identify a proportional relationship between market concentration and market power. However, we have already remarked that the Cournot conjecture is rather restrictive. It seems even more restrictive to assume identical conjectures equal to some arbitrary constant  $\gamma$ . Moreover, note the importance of the assumption that the identical conjectures will have to stay unchanged over time and in case of a change in market structure. This implies assuming that  $\gamma$  and  $HHI$  are independent from each other. Yet, as we argued earlier, a change in market structure, such as the one determined by a merger, whereby the distribution of market shares and the number of firms operating in the industry vary, will have an effect on how firms perceive the conduct of one another. This effect on conduct will not necessarily be the same for all firms (see, for example, the numerical examples section of the text). Therefore, the behavioral restrictions required to derive the market concentration–market power relationship from theory would indeed seem too strong to be accepted.

In the more general (and more plausible) case where  $\frac{\partial y}{\partial y_j} \neq \frac{\partial y}{\partial y_i}, j \neq i$ , the expression for  $\alpha$  does not allow one to derive the HHI. Therefore, under these more general conditions, we cannot rely on the HHI to make predictions regarding firms' conduct. Nonetheless, as stated above, we can test econometrically whether the Cournot or the constant  $\gamma$  restrictions can be rejected against alternative theoretical specifications. As Bresnahan (1989, p. 1031) stated, "Only econometric problems, not fundamental problems of interpretation, cloud this inference about what has been determined empirically."

### Details of the empirical implementation

As we saw above, estimating the degree of market power means being able to identify the conduct parameter  $\theta$  in equation 4, here rewritten for convenience of exposition as

$$p = C'(y_j, \omega_j) - \frac{dp}{dy} y_j \theta_j,$$

where  $p$  now indicates the interest rate on commercial loans,  $y$  indicates the quantity of commercial loans, and  $\omega$ , the vector of factor prices, includes labor cost, capital expenses, and the interest rate on deposits.

For the identification of the parameter of conduct  $\theta_j$ , we need information on the marginal cost function  $C'(y_j, \omega_j)$  and on the inverse of the semi-elasticity on loans demand,  $\frac{1}{\xi} \equiv \frac{\partial p}{\partial y} y$ . One can obtain this additional information at different degrees of refinement, depending in practice on data availability. Angelini and Cetorelli (1998) estimate the parameters of the marginal cost function using the widely used trans-log specification, deriving the following expression:

$$C'(y_j, \omega_j) = \frac{C_j}{y_j} \left[ a_1 + a_2 \ln(y) + \sum_{i=1}^3 b_i \ln(\omega_{ij}) \right].$$

In addition, the parameter  $\tilde{\xi}$  is recovered by estimating simultaneously a loans demand function, specified as

$$\ln(y) = d_1 + d_2 p + d_3 \ln(z) + d_4 [\ln(z)p],$$

where  $z$  is an exogenous shifter of demand, such as investments or GDP.

Finally, although it would be feasible in terms of data availability to test various models of oligopoly, thus identifying distinct parameters of conduct,  $\theta_h \neq \theta_p$ , Angelini and Cetorelli (1998) focus on the determination of an average indicator of conduct,  $\theta$  (see Bresnahan, 1982, for details). Such an indicator gives a first approximation of the overall conditions for the exercise of market power in the industry. Since such a study has never been conducted before for the Italian banking industry, I believe there is high informational value in the average indicator  $\theta$ .

<sup>1</sup>The remainder of the section is based on Appelbaum (1982) and Bresnahan (1989).

<sup>2</sup>The derivation is based on Cowling and Waterson (1976).

### NOTES

<sup>1</sup>Examples of research work on the impact on efficiency of bank mergers include Berger and Humphrey (1992), DeYoung (1997), Hughes et al. (1996), Rhoades (1993b), and Shaffer (1993b). Other authors have sought to evaluate the impact on profitability (for example, Berger and Humphrey, 1992; Cornett and Tehranian, 1992; Pilloff, 1996; and Akhavein et al., 1997) and on production decisions, in particular on lending to small business (for example, Berger et al., 1997).

<sup>2</sup>An alternative measure also used in research is the sum of the market shares of the largest firms in the industry, usually the largest three or four firms.

<sup>3</sup>For a thorough description of the use of mitigating factors in antitrust analysis, see Holder (1993a).

<sup>4</sup>For a detailed description of the official guidelines for competitive analysis in banking, see, for example, Bureau of National Affairs (1984, 1992), Litan (1994), Holder (1993a, 1993b), and Di Salvo (1997).

<sup>5</sup>To be precise, thrift institutions are currently included in the calculation of the HHI. Their market shares, however, have only a 50 percent weight (20 percent for the Justice Department's evaluation procedure), which in any case always determines a reduction in the HHI calculated on banks only. Because of the inclusion of the thrift institutions, the 1,800/200 rule is sometimes called the 1,800/200/50 rule.

<sup>6</sup>The Justice Department's horizontal merger guidelines define markets with a post-merger HHI below 1,000 as unconcentrated and unlikely to present anticompetitive concerns. Markets with a post-merger HHI between 1,000 and 1,800 are defined as moderately concentrated. In such markets a variation in the HHI of less than 100 points is unlikely to present anticompetitive concerns. Markets with a post-merger HHI above 1,800 are defined as highly concentrated, and a variation of the HHI greater than 50 points is thought to have adverse competitive consequences. In the past several years, however, the Justice Department has not challenged a merger unless the post-merger HHI was at least 1,800 and the change in the HHI at least 200 points (see Litan, 1994).

<sup>7</sup>A firm joining a collusive agreement always has an incentive to abandon the agreement (or "cheat") and set prices and/or quantities that maximize its own profits. The costs associated with the collusive agreement are therefore expressed either in terms of the losses suffered by participants in the event that one of them cheats, or in terms of the punishment that a firm would sustain in the event it is caught cheating (for instance, all firms revert to competitive pricing forever after collusion breaks down, hence the deviating firm will no longer be able to make positive profits.)

<sup>8</sup>Important methodological contributions include Iwata (1974), Appelbaum (1979 and 1982), Bresnahan (1982 and 1989), Gollup and Roberts (1979), and Roberts (1984). Applications to the banking industry include Spiller and Favaro (1984), Gelfand and Spiller (1987), Berg and Kim (1994 and 1996), Shaffer (1989 and 1993a), and Shaffer and Di Salvo (1994).

<sup>9</sup>Prager and Hannan (1998) examine a cross-section of such markets, finding that banks operating in markets where a merger produces a substantial increase in concentration have

deposit rates that are lower than those set by banks not operating in such markets. They interpret the result as evidence that these mergers lead to increased market power.

## REFERENCES

- Amel, D.**, 1997, "Antitrust policy in banking: Current status and future prospects," in *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, pp. 166–179.
- Akhavein, J., A. Berger, and D. Humphrey**, 1997, "The effects of megamergers on efficiency and prices: Evidence from a bank profit function," *Review of Industrial Organization*, Vol. 12, No. 1, February, pp. 95–139.
- Angelini, P., and N. Cetorelli**, 1998, "Assessing competition in the Italian banking industry," Federal Reserve Bank of Chicago, mimeo.
- Appelbaum, E.**, 1982, "The estimation of the degree of oligopoly," *Journal of Econometrics*, Vol. 19, August, pp. 287–299.
- \_\_\_\_\_, 1979, "Testing price taking behavior," *Journal of Econometrics*, Vol. 9, February, pp. 283–294.
- Avery, R., R. Bostic, P. Calem, and G. Canner**, 1997, "Changes in the distribution of banking offices," *Federal Reserve Bulletin*, September, pp. 707–725.
- Bain, J.**, 1951, "Relation of the profit rate to industry concentration: American manufacturing, 1936–1940," *Quarterly Journal of Economics*, Vol. 65, pp. 293–324.
- Berg, S. A., and M. Kim**, 1996, "Banks as multioutput oligopolies: An empirical evaluation of the retail and corporate banking markets," in *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, pp. 183–201.
- \_\_\_\_\_, 1994, "Oligopolistic interdependence and the structure of production in banking: An empirical evaluation," *Journal of Money, Credit, and Banking*, Vol. 26, No. 2, pp. 309–322.
- Berger, A., and T. Hannan**, 1989, "The price-concentration relationship in banking," *Review of Economics and Statistics*, Vol. 71, May, pp. 291–299.
- Berger, A., and D. Humphrey**, 1992, "Megamergers in banking and the use of cost efficiency as an antitrust defense," *Antitrust Bulletin*, Fall, pp. 541–600.
- Berger, A., A. Saunders, J. Scalise, and G. Udell**, 1997, "The effects of bank mergers and acquisitions on small business lending," in *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, pp. 241–255.
- Bingaman, A.**, 1995, "Antitrust and banking," paper presented at the Conference on Antitrust and Banking, Office of the Comptroller of the Currency, November 16.
- Bresnahan, T. F.**, 1989, "Empirical studies of industries with market power" in *Handbook of Industrial Organization*, R. Schmalensee and R. D. Willig (eds.), Amsterdam: North Holland, pp. 1011–1057.
- \_\_\_\_\_, 1982, "The oligopoly solution is identified," *Economics Letters*, Vol. 10, pp. 87–92.
- Bureau of National Affairs, Inc., The**, 1992, *Daily Report for Executives*, Special Supplement, April 3.
- \_\_\_\_\_, 1984, *Daily Report for Executives*, Special Supplement, June 15.
- Carlton, D.**, 1986, "The rigidity of prices," *American Economic Review*, Vol. 76, No. 4, pp. 637–658.
- Carlton, D., and J. Perloff**, 1989, *Modern Industrial Organization*, Glenview, IL: Scott Foresman/Little, Brown.
- Cornett, M., and H. Tehranian**, 1992, "Changes in corporate performance associated with bank acquisitions," *Journal of Financial Economics*, Vol. 31, April, pp. 211–234.
- Cowling, K., and M. Waterson**, 1976, "Price–cost margins and market structure," *Economica*, Vol. 43, August, pp. 267–274.
- DeYoung, R.**, 1997, "Bank mergers, X-efficiency and the market for corporate control," *Managerial Finance*, Vol. 23, No. 1, pp. 32–47.
- Di Salvo, J.**, 1997, "Federal Reserve market definitions methodology by District," Casework Conference, Federal Reserve Bank of Philadelphia, October 23–24.

- Gelfand, M., and Spiller, P.**, 1987, "Entry barriers and multiproduct oligopolies," *International Journal of Industrial Organization*, Vol. 5, March, pp. 101–113.
- Gollop, F., and M. Roberts**, 1979, "Firm interdependence in oligopolistic markets," *Journal of Econometrics*, Vol. 10, August, pp. 310–331.
- Hannan, T.**, 1997, "Market share inequality, the number of competitors, and the HHI: An examination of bank pricing," *Review of Industrial Organization*, Vol. 12, February, pp. 23–35.
- Hannan, T., and A. Berger**, 1991, "The rigidity of prices: Evidence from the banking industry," *American Economic Review*, Vol. 81, No. 4, pp. 938–945.
- Hannan, T., and J. Liang**, 1993, "Inferring market power from time-series data. The case of the banking firm," *International Journal of Industrial Organization*, Vol. 11, June, pp. 205–218.
- Holder, C.**, 1993a, "The use of mitigating factors in bank mergers and acquisitions: A decade of antitrust at the Fed," *Economic Review*, Federal Reserve Bank of Atlanta, March–April, pp. 32–44.
- \_\_\_\_\_, 1993b, "Competitive considerations in bank mergers and acquisitions: Economic theory, legal foundations, and the Fed," *Economic Review*, Federal Reserve Bank of Atlanta, January–February, pp. 23–33.
- Hughes, J., W. Lang, L. Mester, and C. Moon**, 1996, "Efficient banking under interstate branching," *Journal of Money, Credit, and Banking*, Vol. 28, No. 4, Part 2, pp. 1045–1071.
- Iwata, G.**, 1974, "Measurement of conjectural variations in oligopoly," *Econometrica*, Vol. 42, September, pp. 947–966.
- Jackson, W., III**, 1997, "Market structure and the speed of adjustment: Evidence of non-monotonicity," *Review of Industrial Organization*, Vol. 12, February, pp. 37–57.
- \_\_\_\_\_, 1992a, "Is the market well defined in bank merger and acquisition analysis?," *Review of Economics and Statistics*, Vol. 74, November, pp. 655–661.
- \_\_\_\_\_, 1992b, "The price–concentration relationship in banking: A comment," *Review of Economics and Statistics*, Vol. 74, May, pp. 373–376.
- Kravitz, P.**, 1997, "Antitrust policy in banking: Comments," in *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, pp. 180–183.
- Kwast, M., M. Starr-McCluer, and J. Wolken**, 1997, "Market definition and the analysis of antitrust in banking," *Antitrust Bulletin*, Winter, pp. 973–995.
- Litan, R.**, 1994, "The ABC of Justice's antitrust assessment of bank acquisitions," *Banking Policy Report*, Vol. 13, No. 10, pp. 16–20.
- Neumark, D., and S. Sharpe**, 1992, "Market structure and the nature of price rigidity: Evidence from the market for consumer deposits," *Quarterly Journal of Economics*, Vol. 107, May, pp. 656–680.
- Peristiani, S.**, 1995, "Do mergers improve the X-efficiency and scale efficiency of U.S. banks? Evidence from the 1980s," Federal Reserve Bank of New York, working paper.
- Pilloff, S.**, 1996, "Performance changes and shareholder wealth creation associated with mergers of publicly traded banking institutions," *Journal of Money, Credit, and Banking*, Vol. 28, No. 3, pp. 294–310.
- Prager, R., and T. Hannan**, 1998, "Do substantial horizontal mergers generate significant price effects? Evidence from the banking industry," *Journal of Industrial Economics*, December.
- Radecki, L.**, 1997, "The expanding geographical reach of retail banking markets," Federal Reserve Bank of New York, mimeo.
- Rhoades, S. A.**, 1995a, "Market share inequality, the HHI, and other measures of the firm composition of a market," *Review of Industrial Organization*, Vol. 10, No. 6, pp. 657–674.
- \_\_\_\_\_, 1995b, "Competition and bank mergers: Directions for analysis from available evidence," Board of Governors of the Federal Reserve System, mimeo.
- \_\_\_\_\_, 1993a, "The efficiency effects of horizontal bank mergers," *Journal of Banking and Finance*, Vol. 17, April, pp. 411–422.
- \_\_\_\_\_, 1993b, "The Herfindahl–Hirschman Index," *Federal Reserve Bulletin*, Vol. 79, March, pp. 188–189.



**Roberts, M.**, 1984, "Testing oligopolistic behavior," *International Journal of Industrial Organization*, Vol. 2, December, pp. 367–383.

**Shaffer, S.**, 1993a, "A test of competition in Canadian banking," *Journal of Money, Credit, and Banking*, Vol. 25, No. 1, pp. 49–61.

\_\_\_\_\_, 1993b, "Can megamergers improve bank efficiency?," *Journal of Banking and Finance*, Vol. 17, April, pp. 423–436.

\_\_\_\_\_, 1989, "Competition in the U.S. banking industry," *Economics Letters*, Vol. 29, No. 4, pp. 321–323.

\_\_\_\_\_, 1983, "Non-structural measures of competition: Toward a synthesis of alternatives," *Economics Letters*, Vol. 12, pp. 349–353.

**Shaffer, S., and J. Di Salvo**, 1994, "Conduct in a banking duopoly," *Journal of Banking and Finance*, Vol. 18, December, pp. 1063–1082.

**Simmons, K., and J. Stavins**, 1998, "Has antitrust policy in banking become obsolete?," *New England Economic Review*, March/April, pp. 13–26.

**Spiller, P., and E. Favaro**, 1984, "The effects of entry regulation on oligopolistic interactions: The Uruguayan banking sector," *The Rand Journal of Economics*, Vol. 9, No. 2, pp. 305–327.

**Suominen, M.**, 1994, "Measuring competition in banking: A two product model," *Scandinavian Journal of Economics*, Vol. 96, No. 1, pp. 95–110.

**Whalen, G.**, 1995, "Non-local concentration, multimarket linkages and interstate banking," paper presented at the Conference on Antitrust and Banking, Office of the Comptroller of the Currency, November 16.

**Wolken, J.**, 1984, "Geographic market delineation: A review of the literature," Board of Governors of the Federal Reserve System, staff study, No. 140, pp. 1–38.