

**1999 Quarter 1**

---

**The Effects of Vertical Integration  
on Competing Input Suppliers** **2**  
by R. Preston McAfee

---

**Banking Consolidation and  
Correspondent Banking** **9**  
by William P. Osterberg and James B. Thomson

1999 Quarter 1  
Vol. 35, No. 1

## The Effects of Vertical Integration on Competing Input Suppliers **2**

by R. Preston McAfee

When a downstream firm buys an input supplier, it can reduce its costs of using that input. Other input suppliers typically respond by pricing more aggressively, given the demand reduction, which tends to lower input supply costs to other firms. Thus, a vertical merger may lower rivals' costs instead of raising them.

## Banking Consolidation and Correspondent Banking **9**

by William P. Osterberg and James B. Thomson

Banking consolidation, spurred on by interstate branching deregulation, is changing the competitive structure of banking markets. Policymakers and regulators have focused on the implications of the ongoing consolidation for customers of banks in retail and wholesale markets. Little attention, however, has been paid to the impact of interstate consolidation on correspondent banking markets—those markets where banks buy and sell inputs used to produce banking services. By studying the era of intrastate branching deregulation, the authors provide some insights on the implications of interstate branching for correspondent banking.

*Economic Review* is published quarterly by the Research Department of the Federal Reserve Bank of Cleveland. To receive copies or to be placed on the mailing list, e-mail your request to [maryanne.kostal@clev.frb.org](mailto:maryanne.kostal@clev.frb.org) or fax it to 216-579-3050.

*Economic Review* is also available electronically through the Cleveland Fed's site on the World Wide Web:  
<http://www.clev.frb.org/research>.

Editors: Michele Lachman  
Lisa McKenna  
Deborah Zorska  
Design: Michael Galka  
Typography: Liz Hanna

Opinions stated in *Economic Review* are those of the authors and not necessarily those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.

Material may be reprinted if the source is credited. Please send copies of reprinted material to the editors.

ISSN 0013-0281

# The Effects of Vertical Integration on Competing Input Suppliers

by R. Preston McAfee

R. Preston McAfee is a professor of economics at the University of Texas at Austin. He thanks Joseph G. Haubrich and James B. Thomson for their beneficial comments.

## Introduction

Vertical integration is a booming phenomenon in many U.S. industries. Massive consolidation of the defense industry has left only three or four developers producing many of the components used in military platforms.<sup>1</sup> Banking also is consolidating at a rapid pace, with integration of related financial services (insurance, credit cards) and input services (check clearing, payments, electronic funds transfer) into parent companies. Telecommunications firms' mergers combine cable, wireless, local wireline, and long-distance services. Simultaneously, firms in other industries are concentrating on their core competencies and selling off related lines of business. Automobile manufacturers, for example, are becoming more reliant on independent or semi-independent parts suppliers.

What are the effects of vertical integration? The large body of literature on this subject might reasonably be described as disjointed. It has focused mostly on providing a rationale for opposing vertical mergers on antitrust grounds. When a firm buys an upstream input supplier that also supplies its downstream competitor, the vertically integrated firm can raise the price of the input to its competitor, thereby obtaining

an advantage in the downstream market. This is the standard "raising-rivals'-cost" argument pioneered by Salop and Scheffman (1987).<sup>2</sup> In extreme cases, the vertically integrated firm might refuse to sell to competitors and, if the input supplier's product was necessary for production, might be able to foreclose its competitors from the downstream market.

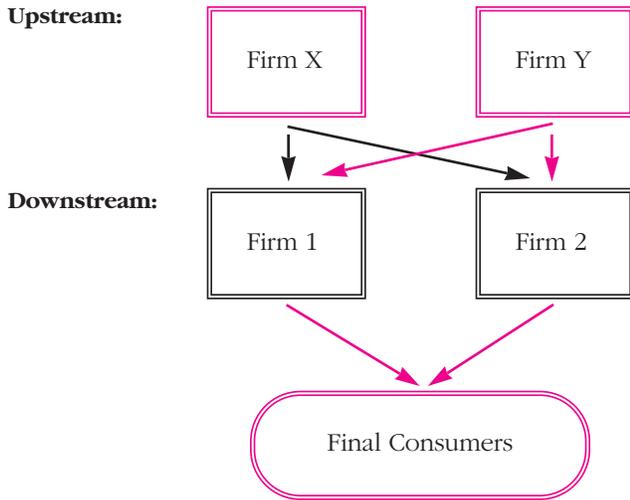
This paper examines an opposing effect of the raising-rivals'-cost theory. In particular, the analysis focuses on other input suppliers' reaction to vertical integration. Its main insight is that vertical integration, by providing easier access to one input, reduces demand for the other inputs and tends to lower their prices. This, in turn, encourages the vertically integrated firm to sell its input at a lower price as well, which may reduce the costs of all inputs. Thus, accounting for the reaction of substitute input suppliers may reverse the traditional conclusions of the raising-rivals'-cost theory.

■ **1** An item like an aircraft or a submarine is a platform, which holds a variety of weapons systems, detection systems like radar or sonar, and other systems like landing gear, engines, and so on.

■ **2** Ordober, Saloner, and Salop (1990) is the best-known treatment. Salinger (1988) and Hart and Tirole (1990) also provide related, and more general, analyses.

FIGURE 1

## Competition Layout



### I. Structure of the Model

The model's general form is set out in figure 1. Two upstream suppliers, X and Y, sell to two downstream firms, which in turn sell to the final consumers. I will focus on the effects of the vertical integration that occurs when firm 1 purchases firm X. Suppose that the products of the upstream firms are imperfect substitutes and that, having purchased firm X, firm 1 will continue to use some of the inputs supplied by Y. Then vertical integration will affect firm Y's pricing decision.<sup>3</sup>

In this paper, I set aside the incentive to raise rivals' costs by assuming that firms 1 and 2 do not compete in the output market. I focus instead on vertical integration's effects on the alternative input supplier and find that vertical integration tends to lower the prices of both inputs to firm 2. The intuition is straightforward: The purchase of firm X by firm 1 lowers the price of input x to firm 1, reducing the demand for y by firm 1. In response to this reduction in demand, firm Y lowers the price of y to both firms. The response of the integrated firm is to lower the price of x to firm 2.

**3** It might seem that services such as check clearing are homogeneous. However, distinct banks have an advantage in being able to clear their own checks quickly, and large banks may have a greater netting out of checks. In addition, distinct suppliers of check clearing may have distinct regional advantages.

The situation is less clear when firms 1 and 2 compete imperfectly in the downstream market. There are two direct effects of the merger: First, the price of x to the combined entity falls, tending to reduce the price of y. Second, the price of x to firm 2 rises, tending to increase the price of y. Either effect can dominate, and the price of y may rise or fall, depending on the extent of substitution between the outputs of firms 1 and 2 and the substitutability of the two inputs.

Let  $x_i, y_i$  denote the demand for the two inputs by firm  $i$ . I assume constant returns to scale. The timing is that the input sellers simultaneously set input prices  $p_x, p_y$ , respectively. Then firms 1 and 2 choose their input quantities and output prices.

### II. Raising Rivals' Costs

The standard raising-rivals'-costs theory is best explained by eliminating firm Y. In this case, X is a monopoly supplier of the input. If x is necessary for production, the merged firm has the ability to foreclose firm 2 from production. Even if x is valuable but not strictly necessary for production, the merged firm can raise the cost of x to firm 2, thereby increasing firm 2's overall costs.

Even in this simple scenario, the price that firm 2 is charged for x can fall. Suppose 1 and 2 barely compete in the final output market. Moreover, suppose firm 1 has significantly more inelastic demand for x, so that the monopoly price for firm 1 exceeds the monopoly price for firm 2. Prior to vertical integration, the price of x will lie between the two monopoly prices. After the merger, the price of x will fall to approximately the monopoly price for firm 2. Moreover, insofar as firms 1 and 2 do compete, the monopoly price for firm 2 will fall, since firm 1's lower marginal cost will make it a more aggressive competitor after the merger.

The standard analysis focuses on the case where X and Y are Cournot competitors with constant marginal costs. In this case, if the merged firm uses its own inputs and withholds output from firm 2, firm 2 is facing a monopoly and will generally experience higher input prices. This is true even when firm Y is actually several firms that are in Cournot competition, although the more firms there are in the input supply market, the smaller is the effect.

The results concerning Cournot input supply generalize to increasing marginal costs. With increasing marginal costs, firm 1 may wish either to sell to or buy from firm Y, even after

the merger with firm X. However, consider the symmetric case, in which X looks like Y and 1 looks like 2. After the merger, firm 1 does not need to buy from firm Y, and thus can increase the costs to firm 2 by refusing to sell.

This literature has played an important role by showing that vertical mergers could potentially foreclose competition downstream. However, the literature has focused primarily on mergers' *bad* effects on rivals, without examining their potential for good effects.

### III. Lowering Rivals' Costs

I start the analysis using the demand for inputs as primitives. To facilitate the analysis, I distinguish between the prices firm X charges to firms 1 and 2. With independent downstream demands, the effect of the merger of X with 1 is to change the input price of x to firm 1. Firm X earns profits on its sale to firm 2 of

$$(1) \quad \pi = (p_x^2 - c_x)x_2(p_x^2, p_y).$$

I divide firm Y's profits into the components earned on firm 1 and firm 2:

$$(2) \quad \psi^1 = (p_y - c_y)y_1(p_x^1, p_y),$$

$$\psi^2 = (p_y - c_y)y_2(p_x^2, p_y).$$

Using numerical subscripts to denote partial derivatives, profit maximization yields

$$(3) \quad \pi_1 = \psi_2^1 + \psi_2^2 = 0.$$

The direct effect of the merger of X and 1 on the input supply prices is to lower  $p_x^1$  from its monopoly level to marginal cost  $c_x$ . Because of the assumed independence of demands for the outputs of 1 and 2, the merged entity will choose the price of  $p_x^2$  to maximize  $\pi$ , and firm Y will maximize the sum of  $\psi^1$  and  $\psi^2$ .

I am assuming that firm Y cannot price discriminate. If both input suppliers are able to do so, nothing changes in the prices charged to firm 2. If firm Y can price discriminate but firm X cannot, then the merger permits firm X to price discriminate, since the only relevant price is that charged to 2. As a consequence,  $p_x^2$  will increase if firm 2's demand for x is less elastic than firm 1's. This will have effects on the price of y, usually of the same direction.

Differentiating the first-order conditions, one obtains

$$(4) \quad \begin{bmatrix} \pi_{11} & \pi_{12} \\ \psi_{21}^1 & \psi_{22}^1 + \psi_{22}^2 \end{bmatrix} \begin{pmatrix} dp_x^2 \\ dp_y \end{pmatrix} + \begin{pmatrix} 0 \\ \psi_{21}^1 \end{pmatrix} dp_x^1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}.$$

This gives

$$(5) \quad \begin{pmatrix} dp_x^2 \\ dp_y \end{pmatrix} = \frac{1}{\Delta} \begin{pmatrix} \pi_{12}\psi_{21}^1 \\ -\pi_{11}\psi_{21}^1 \end{pmatrix} dp_x^1.$$

Stability implies that

$$(6) \quad \Delta = \pi_{11}(\psi_{22}^1 + \psi_{22}^2) - \pi_{12}\psi_{21}^1 > 0.$$

The terms  $\pi_{12}$  and  $\psi_{21}^1$  are similar in that they represent the effect of a competitor's price increase on the marginal profitability of a price increase for the firm. If the input pricing game is one of strategic complements, then these terms are positive. Alternatively (and equivalently), if an increase in the price of one input makes the demand for the other input less elastic, these cross-partials will be positive.

It can be shown that if the downstream production functions have constant elasticity of substitution with constant returns to scale, and demand is constant up to a choke price (which is tantamount to assuming that the downstream quantity is exogenous), then the cross-partials are positive. This special case will be explored in the following numerical simulation.

When these input profit cross-partials are positive, then

$$(7) \quad \frac{dp_x^2}{dp_x^1} > 0, \quad \frac{dp_y}{dp_x^1} > 0.$$

Thus, the merger, which lowers the price of x to firm 1 by eliminating firm X's marginalization, lowers *both* of the input prices to firm 2 as well as the price of y to firm 1.

This result is intuitive. The reduction in the price of x to firm 1 makes that firm's demand for y more elastic, since it now has a less expensive substitute. This causes Y to lower the price of y.<sup>4</sup> The lower price of y induces a reaction from the combined firm—it lowers the price of x.

■ 4 This is where the assumption that firm Y cannot price discriminate is critical. If Y could price discriminate, the reduction in the price of x to firm 1 would reduce the price of y to firm 1 but not to firm 2.

#### IV. Numerical Example

A numerical example illustrates and quantifies the effects described in the theory. Suppose that the two downstream firms can sell one unit each at a price high enough so that each firm will always buy inputs sufficient to produce one unit. The downstream firms have a constant elasticity-of-substitution production technology with constant returns to scale and parameter  $\alpha \in [1/2, 1]^5$ :

$$(8) \quad q = (x^\alpha + y^\alpha)^{\frac{1}{\alpha}}.$$

Let the marginal production costs of the upstream firms be  $c$ .

#### Without Vertical Integration

If there is no vertical integration, the downstream firms minimize  $p_x x + p_y y$  s.t.  $q = 1$ . This gives

$$(9) \quad x = \left( \frac{p_y^{\frac{\alpha}{1-\alpha}}}{p_x^{\frac{\alpha}{1-\alpha}} + p_y^{\frac{\alpha}{1-\alpha}}} \right)^{\frac{1}{\alpha}},$$

$$y = \left( \frac{p_x^{\frac{\alpha}{1-\alpha}}}{p_x^{\frac{\alpha}{1-\alpha}} + p_y^{\frac{\alpha}{1-\alpha}}} \right)^{\frac{1}{\alpha}}.$$

Firm X chooses  $p_x$  to maximize

$$(10) \quad \pi = (p_x - c)x.$$

Routine calculations yield

$$(11) \quad 0 = (1 - \alpha)p_y^{\frac{\alpha}{1-\alpha}} - \alpha p_x^{\frac{\alpha}{1-\alpha}} + c p_x^{\frac{2\alpha-1}{1-\alpha}}.$$

For  $\alpha > 1/2$  and  $p_x > c$ , this equation characterizes a maximum. A symmetric solution to the first-order conditions yields

$$(12) \quad p_x = p_y = \frac{c}{2\alpha - 1}.$$

As  $\alpha \rightarrow 1$ , the goods become perfect substitutes, and prices fall to marginal costs.

#### With Vertical Integration

When firms 1 and X merge, firm 1 can purchase  $x$  at price  $c$ . In this case, the combined entity will price  $x$  to maximize<sup>6</sup>

$$(13) \quad \pi = (p_x - c)x_2$$

$$= (p_x - c) \left( \frac{p_y^{\frac{\alpha}{1-\alpha}}}{p_x^{\frac{\alpha}{1-\alpha}} + p_y^{\frac{\alpha}{1-\alpha}}} \right)^{\frac{1}{\alpha}}.$$

As before, this gives the first-order condition

$$(14) \quad 0 = (1 - \alpha)p_y^{\frac{\alpha}{1-\alpha}} - \alpha p_x^{\frac{\alpha}{1-\alpha}} + c p_x^{\frac{2\alpha-1}{1-\alpha}}.$$

Firm Y faces a more complicated problem because it will generally sell to both firms 1 and 2, and these two firms generally face distinct input prices for  $x$ . Firm Y chooses  $p_y$  to maximize

$$(15) \quad \psi = (p_y - c)(y_1 + y_2) = (p_y - c)$$

$$\left[ \left( \frac{c^{\frac{\alpha}{1-\alpha}}}{c^{\frac{\alpha}{1-\alpha}} + p_y^{\frac{\alpha}{1-\alpha}}} \right)^{\frac{1}{\alpha}} + \left( \frac{p_x^{\frac{\alpha}{1-\alpha}}}{p_x^{\frac{\alpha}{1-\alpha}} + p_y^{\frac{\alpha}{1-\alpha}}} \right)^{\frac{1}{\alpha}} \right].$$

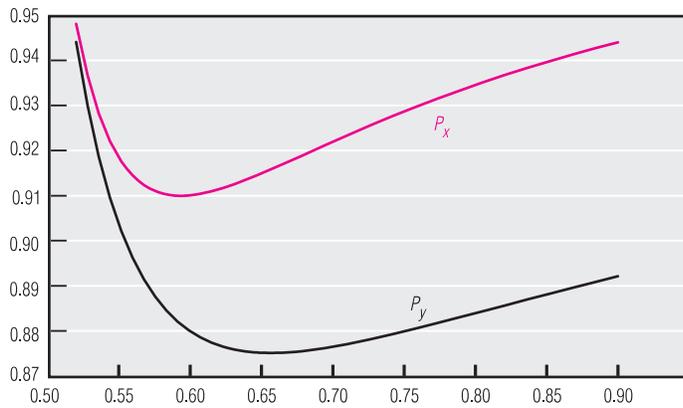
While closed forms for the first-order conditions exist (and are sufficient to characterize equilibrium in the range posited), it is not possible to solve the first-order conditions for the equilibrium prices explicitly because the prices enter these equations in complex ways. Consequently, I have used *Mathematica 3.0* to find the roots of the first-order conditions and to plot the outcome as a function of  $\alpha$ .

To simplify the calculations, note that  $c$  can be set to unity without loss of generality (prices measured in cost units). Moreover, for scaling purposes, it is useful to plot the markup reductions associated with vertical integration rather

■ 5 For  $\alpha \geq 1$ , only one input is chosen. For  $\alpha < 1/2$ , demand is inelastic and the input pricing equations solve with infinite prices.

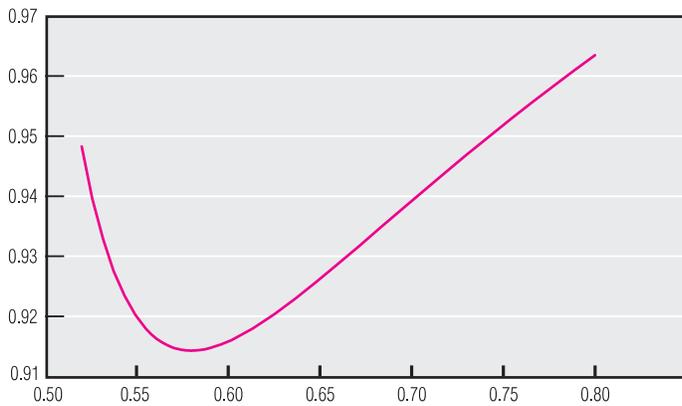
■ 6 Because the vertically integrated firm is assumed not to compete with firm 2, downstream profits can be ignored. However, if there is a low level of competition, then downstream profits must be included here, dramatically complicating the analysis.

FIGURE 2

Input Markups under Vertical Integration<sup>a</sup>

a. As a proportion of the markup without vertical integration, plotted against  $\alpha$ .  
SOURCE: Author's calculations.

FIGURE 3

Firm 2's Marginal Cost under Vertical Integration<sup>a</sup>

a. As a proportion of its marginal cost without vertical integration, plotted against  $\alpha$ .  
SOURCE: Author's calculations.

than the actual prices. Thus, the prices relative to the nonintegrated prices are plotted; in particular, for  $z = x, y$ ,

$$(16) \quad P_z = \frac{p_z - c}{\frac{c}{2\alpha - 1} - c} = \frac{(2\alpha - 1)(p_z - 1)}{2(1 - \alpha)}.$$

When  $P_z = 1$ , there is no cost reduction, while  $P_z = 0$  would be competitive or marginal cost pricing. When the outcome is plotted (see figure 2), several observations emerge. First, the reductions in input prices are significant, on the

order of 5 percent or 10 percent. Second, firm Y reduces its prices more than firm X does. This should be a reasonably general property, since firm X is responding to firm Y's price reduction. In symmetric models like the one examined, the price of the unintegrated input should fall more than the price of the integrated input (to the rest of the world).

In asymmetric models, there is an additional effect. As an independent firm, X priced to serve both firms 1 and 2; therefore, firm X's price is an average of the two monopoly prices associated with 1 and 2. After the merger, firm X will price only for firm 2; this could increase or decrease the postmerger price. The effect identified in this article, however, should continue to hold, using as a benchmark the monopoly price for firm 2 rather than the monopoly price for both downstream firms.

Third, the markups are not monotonic in  $\alpha$ . This is interesting because the prices are monotonic, with prices diverging as  $\alpha \rightarrow 1/2$ , and prices going to costs as  $\alpha \rightarrow 1$ . Simulations suggest that the markup on y is below the markup without vertical integration (as a proportion of the vanishing markup without vertical integration), even in the limit.

While prices are more indicative of the asymmetric effects on the individual input suppliers, firm 2 cares primarily about its marginal cost. In figure 3, the marginal cost is plotted relative to the marginal cost in the absence of vertical integration.

Firm 2's marginal cost is lowered as much as 8½ percent. This amount is, of course, less than the reduction enjoyed by firm 1, but substantial nevertheless.

## V. Banking Applications

The Federal Reserve System recently studied the implications of its potential exit from the provision of retail payments services such as check clearing and electronic payments. In the case of many community banks, especially those in rural markets, the remaining providers of these services would be vertically integrated competitors. Moreover, as Osterberg and Thomson (in this issue) show, branching deregulation is leading to consolidation of both upstream and downstream banking markets. The extant industrial organization literature suggests that increased vertical integration in banking, coupled with consolidation in the interbank market, may have deleterious effects on downstream banking competition.

However, the literature itself is a poor guide to the likelihood of anticompetitive effects. First, much of the research arose from a desire to understand how vertical mergers might matter for antitrust enforcement. In particular, the Clayton Act, which gave courts the ability to block a variety of vertical practices, preceded clear understanding of *any* circumstances in which vertical integration might be harmful to competition. Consequently, a literature developed to show that vertical integration might have a negative effect, instead of assessing the likelihood that vertical integration is harmful to competition.

Second, much of the literature focuses on the Cournot model, primarily for tractability reasons. While Cournot competition might be a reasonable characterization of downstream competition for customers, where firms' capacities are relatively inflexible (at least compared to prices), Cournot competition seems a poor model of the provision of many upstream services like check clearing, where capacity constraints are unlikely to bind. Results from models employing Cournot competition upstream may not be applicable to integration in the banking industry.

Third, the key ingredient of the raising-rivals'-costs story is that the primary motivation for vertical integration is a wish to damage competitors. One plausible future for the banking industry features a handful of very large interstate banks, along with a great number of relatively small local banks. The large institutions will offer banking, mortgage, insurance, finance, and other services, will mainly operate electronically, and will be vertically integrated into most or all financial services areas. In contrast, the local banks will be predominantly rural and will offer personalized service, creating a market niche by exploiting the superior information and goodwill that local interaction provides. These different styles of banks will probably not compete with each other in the minds of most customers. The large banks will compete strongly with other large banks, at least until their numbers are whittled down to three or four in any given region. The rural banks will only face the threat that their best (largest) customers may be induced to use large, inexpensive banks; for most customers, a given rural bank will compete with other rural banks.

In this scenario (which does not result from any study on my part), rural banks will not compete significantly with large banks. As a result, they are not likely to be the target of anticompetitive vertical integration, nor are they likely to be harmed by a reduction in the number of large, vertically integrated banks. The

largest banks may try to harm one another through their pricing of banking service inputs, but these institutions are in the best position to fend for themselves.

The lowering-rivals'-costs story is inapplicable to the present analysis as long as the Federal Reserve continues to provide check clearing and other services at some reasonable approximation of cost. As a consequence, rural banks could benefit from vertical integration of large banks only if the Federal Reserve were inefficient, so that a mechanism for price reductions existed. Prices cannot be dropped below minimum cost.

## VI. Conclusion

The standard analysis of vertical integration's effect on competitors emphasizes the vertically integrated firm's incentive to foreclose downstream rivals or raise their costs. While this effect is natural in some applications, there is an offsetting effect on suppliers of substitute inputs. If firms 1 and 2 compete weakly enough in the output market, the effect on other input suppliers may dominate the foreclosure effect, causing vertical integration to benefit downstream rivals while harming upstream competitors. The harm to upstream competitors, however, lies in reducing their markups over marginal cost, that is, damaging their monopoly power.

A significant aspect of the effect of vertical integration is that both the unmerged input supplier and the vertically integrated firm lower their input prices. The mechanism is that the merger eliminates the markup on the input by the purchased firm. The other input supplier reduces its prices in response to this lower-priced substitute from the merged firm. The vertically integrated firm lowers its input prices to the rest of the world in response to the lowered price of the other input supplier.

Simulations with constant-elasticity-of-substitution production functions indicate potential reductions of as much as 8½ percent in the downstream competitor's marginal costs.

## References

**Hart, Oliver, and Jean Tirole.** “Vertical Integration and Market Foreclosure,” *Brookings Papers on Economic Activity*, Special Issue (1990), pp. 205–76.

**Ordover, Janusz A., Garth Saloner, and Steven C. Salop.** “Equilibrium Vertical Foreclosure,” *American Economic Review*, vol. 80, no. 1 (March 1990), pp. 127–42.

**Salinger, Michael.** “Vertical Mergers and Market Foreclosure,” *Quarterly Journal of Economics*, vol. 103, no. 2 (May 1988), pp. 345–56.

**Salop, Steven C., and David T. Scheffman.** “Cost-Raising Strategies,” *Journal of Industrial Economics*, vol. 36, no. 1 (September 1987), pp. 19–34.

# Banking Consolidation and Correspondent Banking

by William P. Osterberg and James B. Thomson

William P. Osterberg is an economist at the Federal Reserve Bank of Cleveland, and James B. Thomson is a vice president and economist at the Bank. The authors thank Sandy Sterk and Guhan Venkatu for their research support.

## Introduction

Throughout most of the United States' financial history, correspondent banking has been an underpinning of our banking system. Banks use correspondent banking relationships to deliver services to customers in markets where the bank has no physical presence. For example, international correspondent banking relationships are used by large banks seeking to provide services to multinational corporations and in the finance of foreign trade. Due in part to the historical limitations on geographic expansion by banks, correspondent banking has been an important channel for delivering services to domestic customers who may be operating in markets beyond the bank's geographic reach. Correspondent banking markets often allow banks to purchase intermediate goods and services at a lower cost than producing them in-house—hence these markets may have been critical to the success of community banks.

The ongoing consolidation of the U.S. banking system and the increasing geographic scope of large banking institutions could have important implications for the competitive structure and, in turn, the efficiency of correspondent banking markets. Whether these

changes will lead to more or less competition in correspondent banking is unclear. On one hand, consolidation will inevitably lead to a reduction in the number of banks offering correspondent banking services, thereby increasing the market power of the remaining players. On the other hand, given that correspondent banking markets' services are regionally or locally based, interstate consolidation may increase the number of providers in a local market—even though the total number of suppliers has been reduced nationally. Finally, the shrinking number and increased average size of banks may lead to a reduction in the demand for correspondent banking services.

Banking industry consolidation could have important implications for the Federal Reserve Banks in their traditional role as providers of correspondent banking services. As banking becomes less fragmented and more nationally integrated, there is less need for the public correspondent banking network operated by the Federal Reserve Banks. However, if banking consolidation appears to have materially diminished the competitiveness of private correspondent banking markets, then the continued role of Federal Reserve Banks as public competitors may be warranted.

TABLE 1

FDIC-Insured Commercial Banks<sup>a</sup>

| Bank size              | Number of banks | Total assets <sup>b</sup> |
|------------------------|-----------------|---------------------------|
| Less than \$25 million | 1,370           | 22,496                    |
| \$25 to \$50 million   | 2,026           | 75,077                    |
| \$50 to \$100 million  | 2,251           | 161,502                   |
| \$100 to \$300 million | 2,259           | 371,720                   |
| \$300 to \$500 million | 400             | 152,924                   |
| \$500 to \$1 billion   | 304             | 209,387                   |
| \$1 to \$3 billion     | 206             | 332,204                   |
| \$3 to \$10 billion    | 104             | 596,790                   |
| \$10 billion or more   | 64              | 3,260,657                 |
| Total institutions     | 8,984           | 5,182,759                 |

a. As of June 30, 1988.

b. In millions of dollars

SOURCE: Federal Deposit Insurance Corporation, *Statistics on Banking* (<http://www.fdic.gov/databank/sob/>).

In this article we reexamine some of these issues, focusing on the impact of regulatory changes to permit intrastate branching and interstate banking. Our concern is primarily with the impact of such changes on concentration in correspondent balances and domestic deposit markets. We utilize the call report data compiled by the Federal Financial Institutions Examinations Council (FFIEC) and the *Summary of Deposits* data prepared by the Federal Deposit Insurance Corporation (FDIC). Any changes in concentration could have important implications for the efficiency and competitiveness of banking markets.

The paper is organized as follows: Section I provides an overview of correspondent banking. The correspondent banking literature is reviewed in section II. Section III furnishes a description of the data and the empirical strategy. The results are discussed in section IV. Finally, conclusions and recommendations are presented in section V.

## I. An Overview of Correspondent Banking

All firms face the fundamental decision of whether to make or buy a particular input used in production. For example, an automobile manufacturer must decide whether to make its own engines and transmissions or to buy them from an outside supplier. Computer manufacturers must decide whether to make or buy the processors used in their machines. Likewise, a bank must decide whether to sort and present

for collection checks drawn on other banks that have been deposited in customer accounts, or to contract with a third party to perform this function. For firms, the make-or-buy decision depends on a number of factors, including the nature of the input's production function, the firm's demand for the good relative to the market, and the competitive structures of the market for the input good and the market for the final good.

Banking literature refers to correspondent banking as the purchase (by banks) of input from other banks, central banks, and bank clearinghouses. For instance, when a bank in Cleveland sends checks to its local Federal Reserve Bank for collection, it has purchased correspondent banking services from that Reserve Bank. Another example is a recent agreement between J. P. Morgan and Chase Manhattan Bank, in which Chase provides European currency clearing services for Morgan.<sup>1</sup> The main services provided by correspondent banks are discussed in section II and in the appendix.

Correspondent banking relationships are relevant to the cost structure of the U.S. depository institutions sector. As table 1 shows, the legacy of our unit-banking system—a consequence of intrastate and interstate branching restrictions—is a highly fragmented banking system with a large number of small, locally and regionally based institutions. Economies of scale in the production of inputs associated with the provision of many types of bank services, especially payments services, exceed the range of output for most community banks.<sup>2</sup> Furthermore, community banks lack the geographic scope needed to capitalize on network externalities. Hence, in the absence of correspondent banking markets, community banks would likely be less efficient providers of financial services and would have more difficulty surviving in increasingly competitive banking markets.

In a typical correspondent banking relationship, the supplier of services is another bank. The provider of services in the input market can be viewed as a vertically integrated firm that may compete with the community bank in the output market. For the integrated firm, the benefits of supplying correspondent banking services are clear. First, there are economies of scope between production of input for its own products and production of correspondent banking products. Second, providing correspondent banking services may allow the integrated

■ 1 See Steven Marjanovic, "Morgan Taps Rival Chase for Europe Clearances," *The American Banker*, August 11, 1998, p. 1.

■ 2 See Bauer and Ferrier (1996).

bank to more fully exploit economies of scale or network effects. This, in turn, lowers the cost of producing (or increases the demand for) its own downstream products.

The competitive structure of the correspondent banking market may also be relevant to the structure of the markets for bank products. Industrial organization theory tells us that if the integrated firm has substantial monopoly power in the upstream (input) market, then it may use that power to damage its rival in the downstream market.<sup>3</sup> Thus, if the supplier of correspondent banking services competes with its customer (the community bank) in the output market, then it may price its services above the average cost of production—thereby damaging the community bank’s ability to compete. The integrated bank’s ability to do this depends on the competitive structure of the upstream and downstream markets.

## II. Literature Review

A correspondent banking relationship involves a correspondent bank, which provides the services, and a respondent bank receiving them. The respondent usually pays for the services by maintaining correspondent balances at the larger bank. The mix of services that might be provided is broad, but appears to emphasize check processing, especially for smaller banks, and loan participation. Other services include providing reports on economic conditions, making securities recommendations, and safe-keeping securities. Correspondents also have made markets for federal funds, in effect reducing the minimum size of such transactions.<sup>4</sup>

Correspondent services are not paid for directly with fees, but rather implicitly through maintaining deposit balances.<sup>5</sup> Some critics have claimed that greater efficiency would result from direct payment and have implied that smaller banks might not always have known the true cost of the services.<sup>6</sup> Banks, however, historically have opposed the introduction of direct fees.

The early literature on correspondent banking appears to have grown in response to two developments: One was the decline in Federal Reserve membership, which led to the establishment of regional Federal Reserve check processing centers in the early 1970s and the passage of the Depository Institutions Deregulation and Monetary Control Act of 1980. The other was the prospect of increased merger activity in banking, rationalized by a purported positive impact on banking efficiency. Early research

explored whether correspondent banking allowed smaller banks to gain access, or gain access at a lower cost, to some of the services that might be provided through mergers or acquisitions. This would imply, for example, that correspondent relationships provided alternatives to mergers permitted by interstate banking, and that the correspondent system might be affected by such developments. Another closely related issue was economies of scale in the production of important banking services. Certain services, such as processing of international financial transactions or specialized loan programs, were more likely than others to be provided at a lower cost by larger banks. An issue related to the impact of mergers on efficiency was whether holding-company affiliation might allow smaller banks to gain access to economies of scale in certain services provided by the lead bank, which is presumably larger. The argument had been made that allowing small banks to join holding companies would allow them to reduce the number of correspondent accounts—and the total amount of interbank balances held—but maintain the same level of correspondent services. However, evidence as early as 1970 showed that, contrary to this argument, the average size of interbank accounts appeared the same for smaller banks in or out of holding companies. This suggested that holding-company affiliation did not provide small banks with meaningful opportunities to economize on holdings of interbank balances.<sup>7</sup> Another alleged advantage of holding-company affiliation was the increased ease of getting loan participations. While some evidence in favor of this was found, the related claim that banks facing funding or capital constraints would have an easier time placing loan participations with their respondents (that is, the banks purchasing correspondent services) could not be supported.

■ 3 See McAfee (this issue) for a discussion of the damage-your-rival argument and a counterexample.

■ 4 Knight (1970a) reported that about 90 percent of the banks surveyed indicated that their correspondents offered to help with international banking services, collections, bank wire, and advice on consumer credit, credit information, and electronic data processing.

■ 5 Implicitly, as was pointed out by Flannery (1983), the correspondent should provide services costing  $[1 - \rho]r$ , where  $\rho$  is the reserve requirement and  $r$  is the market interest rate.

■ 6 Although fees are not charged directly for correspondent services, detailed account analyses were performed to estimate the revenue and expenses from correspondent accounts (see Knight [1970a]).

■ 7 See Knight (1970a, 1970b).

We are not aware of any studies that directly tackle the question of whether efficiency is enhanced by the presence of a correspondent banking network. A few studies take an indirect look at efficiency by analyzing overall economies of scale for banks, taking account of the provision of correspondent banking services—something that previous work on economies of scale using functional cost analysis (FCA) data failed to control for. Dunham (1981) found that after controlling for the provision of correspondent banking services, noncorrespondent banking services exhibited economies of scale in production—something that previous studies were unable to find. This could be the result of two factors: First, if small banks trade relatively more correspondent balances for services (with such payments not reflected in the FCA data), they would appear more efficient. Second, larger banks producing more “due to” accounts, which are more service-intensive, would appear to have higher costs.

Flannery (1983) also re-estimated bank cost functions after adjusting for the understatement the cost to the bank purchasing correspondent services. He found that branch bank scale economies were overestimated, but those of unit banks were not affected. Gilbert (1983) found economies of scale in the provision of correspondent services, which he claims were due to an inverse relation between the amount of demand balances due to banks and their short-run variability.

Prior to the move toward interstate banking, it was already apparent that correspondent banking might allow smaller banks to overcome the obstacles to geographic diversification posed by interstate banking restrictions. One possibility is that correspondent banking would help effect a transfer of funds from surplus to deficit areas. Loan participations are a major vehicle for this. Funds are transferred from the larger correspondent bank to a smaller respondent bank to meet a loan request that either exceeds funds available through local deposits or exceeds legal lending limits. Payment for such correspondent services is made in terms of the respondent’s balances at the correspondent bank. Knight (1970b) presents evidence supporting the hypothesis that correspondent banking provides a channel for funds to flow from surplus to deficit areas. This author documents a large net flow of funds to correspondents, even from respondent banks that originated loan participations. The appendix provides further detail on this branch of the literature.

The possibility that correspondent banking might affect the competitiveness of downstream markets was recognized early on. Consistent with occasional concerns that correspondents might steal business from their respondents, Knight (1970a) indicates that money market correspondents would participate only if the originating bank would reciprocate in participations. Anecdotal evidence suggests that some correspondents had stated the view that borrowers consistently unable to obtain loans from the respondent should switch to the correspondent for lending.

Early work presaged a concern over the impact of regulatory policies on the correspondent banking system. Obviously, any regulatory change that influenced correspondent services, such as check-clearing arrangements, might have a direct effect on the use of private correspondents for such services. Knight (1972) focuses on the impact of the Federal Reserve System’s development of regional check processing centers (RCPCs) and the change in Regulation J requiring all banks to pay for cash letters received from Federal Reserve Banks on the day of receipt in immediately available funds. The creation of the RCPCs was seemingly intended to improve the efficiency of the check-clearing mechanism by permitting all participating banks to route items drawn on other participating banks to the clearing center on the day of the deposit. The Regulation J change may have had the effect of transferring collected funds from outlying (rural) banks (which had been granted a delay in paying after receipt of a cash letter) to city banks. For Federal Reserve member banks this regulatory change effectively reduced the burden of reserve requirements. However, during this time in most states, nonmember banks could count correspondent balances toward reserve requirements set by their state banking regulatory agency. Therefore, a differential impact might have been felt by outlying nonmember banks since they would not have had the advantage of reduced reserve requirements.

Other Federal Reserve System policies have had key regulatory influences on the development of the correspondent banking system. Kane (1982) discusses Title I of the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMC), which mandated that the Fed make its correspondent services available to all depository institutions and that they be explicitly priced. Historically, the Fed had offered correspondent services to members free of charge, in part to offset costs associated with then-higher reserve requirements faced by

TABLE 2

## State Branching Status

| State                | Current status <sup>a</sup> | Year switched to limited branching | Year switched to statewide branching | Effective date for interstate banking | State          | Current status <sup>a</sup> | Year switched to limited branching | Year switched to statewide branching | Effective date for interstate banking |
|----------------------|-----------------------------|------------------------------------|--------------------------------------|---------------------------------------|----------------|-----------------------------|------------------------------------|--------------------------------------|---------------------------------------|
| Alabama              | Statewide                   |                                    | 1987                                 | 5/31/97                               | Nebraska       | Limited                     |                                    |                                      | 5/31/97                               |
| Alaska               | Statewide                   |                                    |                                      | 1/1/94                                | Nevada         | Statewide                   |                                    |                                      | 9/28/95                               |
| Arizona              | Statewide                   |                                    |                                      | 8/31/96                               | New Hampshire  | Statewide                   |                                    |                                      | 6/1/97                                |
| Arkansas             | Limited                     |                                    |                                      | 5/31/97                               | New Jersey     | Statewide                   |                                    |                                      | 4/17/96                               |
| California           | Statewide                   |                                    |                                      | 10/2/95                               | New Mexico     | Statewide                   | 1991                               |                                      | 6/1/96                                |
| Colorado             | Limited                     | 1991                               |                                      | 6/0/97                                | New York       | Statewide                   |                                    |                                      | 2/6/96                                |
| Connecticut          | Statewide                   |                                    |                                      | 6/27/95                               | North Carolina | Statewide                   |                                    |                                      | 6/22/95                               |
| Delaware             | Statewide                   |                                    |                                      | 9/29/95                               | North Dakota   | Limited                     | 1991                               |                                      | 5/31/97                               |
| District of Columbia | Statewide                   |                                    |                                      | 6/13/96                               | Ohio           | Statewide                   |                                    | 1990                                 | 5/21/97                               |
| Florida              | Statewide                   |                                    |                                      | 5/31/97                               | Oklahoma       | Statewide                   |                                    | 1993                                 | 5/31/97                               |
| Georgia              | Limited                     |                                    |                                      | 6/1/97                                | Oregon         | Statewide                   |                                    |                                      | 2/27/95                               |
| Hawaii               | Statewide                   |                                    |                                      | 6/1/97                                | Pennsylvania   | Statewide                   |                                    | 1990                                 | 7/6/95                                |
| Idaho                | Statewide                   |                                    |                                      | 7/1/95                                | Rhode Island   | Statewide                   |                                    |                                      | 6/20/95                               |
| Illinois             | Statewide                   | 1988                               | 1994                                 | 6/1/97                                | South Carolina | Statewide                   |                                    |                                      | 7/1/96                                |
| Indiana              | Statewide                   |                                    | 1991                                 | 3/15/96                               | South Dakota   | Statewide                   |                                    |                                      | 7/1/96                                |
| Iowa                 | Limited                     |                                    |                                      | 6/1/97                                | Tennessee      | Statewide                   |                                    | 1990                                 | 6/1/97                                |
| Kansas               | Statewide                   | 1988                               | 1990                                 | 6/1/97                                | Texas          | Statewide                   |                                    | 1990                                 | 8/28/95                               |
| Kentucky             | Limited                     |                                    |                                      | 6/1/97                                | Utah           | Statewide                   |                                    |                                      | 6/1/95                                |
| Louisiana            | Statewide                   |                                    | 1990                                 | 6/1/97                                | Vermont        | Statewide                   |                                    |                                      | 5/30/96                               |
| Maine                | Statewide                   |                                    |                                      | 1/1/97                                | Virginia       | Statewide                   |                                    |                                      | 7/1/95                                |
| Maryland             | Statewide                   |                                    |                                      | 9/29/95                               | Washington     | Statewide                   |                                    |                                      | 6/6/96                                |
| Massachusetts        | Statewide                   |                                    |                                      | 8/2/96                                | West Virginia  | Statewide                   |                                    | 1988                                 | 5/31/97                               |
| Michigan             | Statewide                   |                                    | 1987                                 | 11/29/95                              | Wisconsin      | Statewide                   |                                    | 1990                                 | 6/1/97                                |
| Minnesota            | Limited                     |                                    |                                      | 6/1/97                                | Wyoming        | Limited                     | 1991                               |                                      | 5/31/97                               |
| Mississippi          | Statewide                   |                                    | 1990                                 | 5/1/97                                |                |                             |                                    |                                      |                                       |
| Missouri             | Statewide                   | 1987                               | 1991                                 | 6/1/97                                |                |                             |                                    |                                      |                                       |
| Montana              | Limited                     | 1990                               |                                      | 3/21/97                               |                |                             |                                    |                                      |                                       |

a. As of June 30, 1996.

SOURCE: Federal Deposit Insurance Corporation, Annual Reports (various).

member banks. Rising interest rates increased the opportunity cost of holding reserves. Hence, rising interest rates during the 1970s would have increased the cost of Fed membership, and the ability of banks to leave the System may have increased pressure on the Fed to offer additional services. These included access to the discount window and the hope of receiving preferential regulatory treatment.<sup>8</sup> Other aspects of Federal Reserve membership and relevant regulation are discussed in the appendix.

### III. Framework for Analysis and Data

Data limitations constrain our choice of an analytical framework likely to have empirical applicability. Many of the studies cited above utilize data generated by one-time surveys of specific geographical regions. “Due to” and “due from” balances, corresponding to the lia-

bility and assets entries for the deposits of the respondent with the correspondent, respectively, are provided on the FFIEC’s call report forms. However, these reports do not allow us to match up the two banks. In addition, the due-to numbers are not available for small banks. Aside from information about organizational structure, location, and mergers and acquisition history, few of the variables analyzed in the studies cited previously are available in regular reports. Our approach here focuses on the correspondent balance numbers and the data on overall domestic deposits. Supplemental data on deposit markets is constructed using the FDIC’s *Summary of Deposits* data, which are available on an annual basis.

■ 8 In Kane’s analysis, the fact that private correspondents offer a wider array of services implies that the balance requirements set by them exceed the Fed’s reserve requirements on the same balances.

TABLE 3

## Banks and Branches

| Year | Banks  | Branches | Offices |
|------|--------|----------|---------|
| 1966 | 13,529 | 16,842   | 30,371  |
| 1967 | 13,506 | 17,884   | 31,390  |
| 1968 | 13,479 | 18,966   | 32,445  |
| 1969 | 13,464 | 20,149   | 33,613  |
| 1970 | 13,502 | 21,597   | 35,099  |
| 1971 | 13,602 | 23,080   | 36,682  |
| 1972 | 13,721 | 24,566   | 38,287  |
| 1973 | 13,964 | 26,403   | 40,367  |
| 1974 | 14,218 | 28,384   | 42,602  |
| 1975 | 14,372 | 29,929   | 44,301  |
| 1976 | 14,397 | 31,068   | 45,465  |
| 1977 | 14,397 | 32,836   | 47,233  |
| 1978 | 14,378 | 34,524   | 48,902  |
| 1979 | 14,351 | 36,521   | 50,872  |
| 1980 | 14,421 | 38,458   | 52,879  |
| 1981 | 14,401 | 40,500   | 54,901  |
| 1982 | 14,435 | 39,485   | 53,920  |
| 1983 | 14,454 | 40,548   | 55,002  |
| 1984 | 14,483 | 41,485   | 55,968  |
| 1985 | 14,402 | 42,970   | 57,372  |
| 1986 | 14,193 | 44,054   | 58,247  |
| 1987 | 13,705 | 45,017   | 58,722  |
| 1988 | 13,119 | 46,036   | 59,155  |
| 1989 | 12,697 | 47,650   | 60,347  |
| 1990 | 12,329 | 50,017   | 62,346  |
| 1991 | 11,909 | 51,591   | 63,500  |
| 1992 | 11,449 | 51,544   | 62,993  |
| 1993 | 10,944 | 52,467   | 63,411  |
| 1994 | 10,431 | 54,656   | 65,087  |
| 1995 | 9,921  | 56,028   | 65,949  |
| 1996 | 9,511  | 57,258   | 66,769  |
| 1997 | 9,125  | 59,773   | 68,898  |

SOURCE: Federal Deposit Insurance Corporation, *Statistics on Banking* (<http://www.fdic.gov/databank/sob/>).

TABLE 4

## National Correspondent Banking Deposit Shares

| Year <sup>a</sup> | Market share (percent) |              |             |
|-------------------|------------------------|--------------|-------------|
|                   | Top 50 banks           | Top 10 banks | Top 5 banks |
| 1984              | 28.18                  | 11.92        | 7.51        |
| 1985              | 27.79                  | 14.78        | 10.51       |
| 1986              | 26.89                  | 11.87        | 8.07        |
| 1987              | 26.47                  | 11.53        | 7.78        |
| 1988              | 25.53                  | 10.94        | 7.05        |
| 1989              | 27.82                  | 13.15        | 8.66        |
| 1990              | 29.79                  | 12.99        | 8.64        |
| 1991              | 28.61                  | 12.89        | 8.95        |
| 1992              | 29.43                  | 12.38        | 7.76        |
| 1993              | 30.44                  | 13.39        | 7.99        |
| 1994              | 32.64                  | 13.33        | 8.40        |
| 1995              | 33.52                  | 14.94        | 8.52        |
| 1996              | 36.57                  | 16.07        | 9.99        |

a. As of June 30.

SOURCE: Authors' calculations.

The sample period studied here covers June 30, 1984, to June 30, 1996, and includes many shifts from unit banking to limited branching, and from limited branching to statewide branching. Table 2 details the history of such regulatory changes during our sample period.

While numerous analyses have focused on the issue of whether banking efficiency has been enhanced by the recent wave of mergers and acquisitions (M&As), the role of correspondent banking has been unclear. Ideally, our analysis of changing concentration in correspondent banking markets would take this factor into account. It is not possible, however, to directly examine the effect of M&As on efficiency using the existing data.

One possibility is that M&As would render unnecessary the pre-existing correspondent relationships involving the formerly independent banks. On the other hand, they could reduce the competitiveness and efficiency of the remaining system. Similar concerns arise with the changes in branching status that we identify. Branching economies might be affected. The presumption is that the largest bank is the correspondent. After the absorption of unit banks as branches of the new bank, the correspondent deposits no longer appear on the reports at the bank level upon which we focus.

Finally, data on market prices charged for private correspondent banking services do not exist, especially at the individual market level. Therefore, we rely on measures of market concentration, such as the Herfindahl index, to investigate the impact of branching deregulation on the structure of the interbank market. It is important to note, however, that market concentration measures are not always good proxies for the degree of competition in a market. Hence, increased concentration may not necessarily indicate a less competitive market—especially if the event driving market consolidation increases the degree of potential competition (contestability) in that market.

## IV. Results

Tables 3 and 4 illustrate the ongoing consolidation of the domestic commercial banking industry and its implications for the correspondent banking market nationwide. While the number of banks has fallen steadily from 1984 to 1996, the market share of the top 50 correspondent banks has risen from 28.18 percent to 36.57 percent of all deposits due to banks over the same time period. Similar results are found when looking at the market share held by the

TABLE 5

Deposits Due to Banks:  
State-Level Herfindahl

| Year <sup>a</sup> | All states | Statewide branching | Limited branching | Unit banking |
|-------------------|------------|---------------------|-------------------|--------------|
| 1984              | 1,302.32   | 1,814.80            | 730.67            | 987.02       |
| 1985              | 1,328.69   | 2,060.31            | 577.37            | 632.83       |
| 1986              | 1,315.64   | 1,989.67            | 632.66            | 746.03       |
| 1987              | 1,322.13   | 1,863.52            | 657.61            | 847.76       |
| 1988              | 1,467.51   | 1,861.73            | 804.60            | 1,646.37     |
| 1989              | 1,379.42   | 1,826.39            | 612.90            | 1,635.88     |
| 1990              | 1,416.91   | 1,549.98            | 803.99            | 2,271.65     |
| 1991              | 1,476.31   | 1,580.03            | 1,139.21          |              |
| 1992              | 1,507.27   | 1,622.51            | 1,132.74          |              |
| 1993              | 1,379.61   | 1,396.87            | 1,316.83          |              |
| 1994              | 1,617.10   | 1,679.40            | 1,361.66          |              |
| 1995              | 1,602.90   | 1,665.53            | 1,346.11          |              |
| 1996              | 1,510.14   | 1,611.97            | 1,092.68          |              |

a. As of June 30.

SOURCE: Authors' calculations.

TABLE 6

Deposits Due from Banks:  
State-Level Herfindahl

| Year <sup>a</sup> | All states | Statewide branching | Limited branching | Unit banking |
|-------------------|------------|---------------------|-------------------|--------------|
| 1984              | 2,121.30   | 3,084.66            | 1,210.53          | 1,160.00     |
| 1985              | 2,014.97   | 3,140.98            | 968.51            | 850.74       |
| 1986              | 2,240.79   | 3,561.01            | 1,021.35          | 858.86       |
| 1987              | 2,011.15   | 2,994.41            | 921.99            | 863.66       |
| 1988              | 1,854.20   | 2,714.22            | 895.89            | 488.00       |
| 1989              | 1,944.99   | 2,927.31            | 772.17            | 666.13       |
| 1990              | 2,176.47   | 2,794.63            | 699.32            | 787.21       |
| 1991              | 2,316.39   | 2,778.43            | 814.77            |              |
| 1992              | 2,591.18   | 2,951.34            | 1420.68           |              |
| 1993              | 2,708.97   | 3,186.43            | 972.77            |              |
| 1994              | 2,700.65   | 3,141.37            | 893.69            |              |
| 1995              | 3,022.00   | 3,486.61            | 1,117.09          |              |
| 1996              | 2,984.88   | 3,307.98            | 1,660.20          |              |

a. As of June 30.

SOURCE: Authors' calculations.

top 10 and top five correspondent banks nationwide. Despite the increased concentration of correspondent banking deposits shown in table 4, the national market for correspondent banking remains relatively unconcentrated, with no firm controlling more than 3.6 percent of deposits due to banks.

Unfortunately, most markets for correspondent banking services are likely to be local or

regional in scope and, therefore, national concentration measures may prove misleading. For example, if correspondent banking markets are effectively segmented by branching restrictions (intrastate or interstate), then low levels of market concentration at the national level may be consistent with highly concentrated markets at the state or local level. Moreover, to the extent that banking consolidation increases the contestability of correspondent banking markets, increases in market concentration at the national level may lead to more competitive correspondent banking markets at the state and local levels.

Data on correspondent banking markets are collected at the bank level, limiting our ability to accurately gauge the competitiveness of these markets. Moreover, the degree of aggregation in the data precludes us from looking at measures of concentration below the state level for both deposits due to banks (correspondent deposits) and deposits due from banks (respondent deposits).

To examine trends in market concentration at the state level, we construct Herfindahl indexes for deposits due to banks (correspondent deposits) and for deposits due from banks (respondent deposits). Tables 5 and 6 report the average Herfindahl for all states, states with statewide branching, states with limited branching, and unit banking states. Table 5 shows that correspondent banking is more concentrated, on average, in statewide branching states than it is in states with more restrictive branching laws. However, while mean concentration for the total of all states has risen over the sample period, holdings of correspondent deposits have become less concentrated in statewide branching states. The increasing mean concentration of correspondent deposits for all states over time likely reflects the ongoing consolidation of the banking system, especially in those states switching to less restrictive branching laws during the sample period. Moreover, the decline in the mean concentration of correspondent deposits for the statewide branching states over the sample period may simply reflect the inclusion of new states in the sample. If correspondent deposit markets in states that switched to statewide branching during the sample period are less concentrated than the average statewide branching state in the sample, then mean concentration for the sample should decrease over time.

Table 6 shows that respondent deposits (deposits due from banks) are also more concentrated in statewide branching states. To the extent that banking markets are more consolidated

TABLE 7

**Domestic Deposits:  
State-Level Herfindahl**

| Year <sup>a</sup> | All states | Statewide branching | Limited branching | Unit banking |
|-------------------|------------|---------------------|-------------------|--------------|
| 1984              | 803.57     | 1,413.75            | 245.13            | 155.41       |
| 1985              | 839.97     | 1,476.55            | 264.17            | 146.19       |
| 1986              | 829.74     | 1,434.67            | 290.64            | 152.30       |
| 1987              | 822.19     | 1,341.83            | 275.91            | 144.49       |
| 1988              | 874.87     | 1,363.18            | 305.17            | 191.21       |
| 1989              | 924.22     | 1,431.53            | 324.04            | 243.95       |
| 1990              | 948.53     | 1,216.49            | 310.75            | 284.19       |
| 1991              | 975.79     | 1,175.25            | 327.55            |              |
| 1992              | 1,037.58   | 1,254.06            | 334.01            |              |
| 1993              | 1,035.08   | 1,208.44            | 404.70            |              |
| 1994              | 1,079.96   | 1,233.59            | 450.09            |              |
| 1995              | 1,165.78   | 1,318.10            | 541.27            |              |
| 1996              | 1,301.08   | 1,449.48            | 692.67            |              |

a. As of June 30.

SOURCE: Authors' calculations.

TABLE 8

**Domestic Deposits: Weighted  
Average Herfindahls for All Markets**

| Date | All states | Statewide branching | Limited branching | Unit banking |
|------|------------|---------------------|-------------------|--------------|
| 1984 | 2,269.58   | 2,502.29            | 2,309.44          | 1,379.66     |
| 1985 | 2,281.17   | 2,512.56            | 2,368.29          | 1,320.86     |
| 1986 | 1,886.94   | 1,983.10            | 2,288.14          | 1,337.33     |
| 1987 | 1,888.29   | 1,970.49            | 2,192.11          | 1,262.59     |
| 1988 | 2,451.90   | 2,597.36            | 2,231.45          | 1,750.54     |
| 1989 | 2,566.49   | 2,665.32            | 2,298.59          | 2,318.25     |
| 1990 | 2,674.95   | 2,786.77            | 1,850.64          | 2,046.39     |
| 1991 | 2,717.42   | 2,800.73            | 1,709.98          |              |
| 1992 | 2,936.77   | 3,057.20            | 1,723.09          |              |
| 1993 | 2,946.38   | 3,061.80            | 1,726.98          |              |
| 1994 | 3,048.91   | 3,024.30            | 2,298.79          |              |
| 1995 | 3,120.80   | 3,100.03            | 2,306.78          |              |
| 1996 | 3,280.86   | 3,182.87            | 2,922.62          |              |

a. As of June 30.

SOURCE: Authors' calculations.

in statewide branching states, one would expect to see fewer banks placing deposits with correspondent banks and, therefore, greater concentration. Unlike correspondent balances, however, respondent deposits do not clearly increase or decrease through time either for the full sample or for statewide branching states. Therefore, the implication of interstate branching on the concentration of respondent deposits is unclear.

The negative relationship between concentration in interbank deposit markets and the stringency of geographic limitations (that is, branching restrictions) may simply be a consequence of more concentrated deposit markets. That is, relaxation of branching restrictions may increase the concentration of banking deposits—a likely outcome of a more consolidated banking system—which, in turn, leads to more concentrated interbank-deposit markets. Tables 7 and 8 seem to bear this point out: Table 7 exhibits average Herfindahls at the state level for domestic deposits. Table 8 presents average market-level Herfindahls grouped by state branching status.<sup>9</sup> In both tables, statewide branching states tend to exhibit more deposit market concentration than other states, and the level of concentration has tended to increase over the sample period.

Simple correlation analysis confirms a high degree of correlation between interbank-deposit concentration and concentration measures of domestic deposit markets. The Spearman (Pearson) correlation coefficient between the state-level Herfindahl indexes for domestic deposits and correspondent deposits is 0.7033 (0.7153). The Spearman (Pearson) correlation coefficient between the state-level Herfindahl indexes for domestic deposits and respondent deposits is 0.7131 (0.6756). Moreover, the structure of the correspondent deposit market and the respondent deposit market are highly correlated with a Spearman (Pearson) correlation coefficient of 0.45665 (0.52298).

One problem with looking at time trends in Herfindahl indexes across states with different branching laws is that a number of states changed their laws during the sample period. This is evident from the disappearance of unit banking in the sample in 1991. All changes in branching status favored a less restrictive form of branching regulation. Therefore, a measure of caution is warranted when comparing trends in concentration across subcategories in tables 5 through 8.

Fortunately, we can directly test the impact of relaxing intrastate branching restrictions on deposit market concentration. For all states that changed branching status during the sample period (there were 22 such switches), we constructed state-level Herfindahls for domestic deposits, correspondent deposits, and respondent deposits two years prior to and two years

■ 9 In table 9, we assume that for bank offices located in MSAs the relevant market is the MSA. For bank offices located in non-MSA counties, the market is defined to be the county where the office is located.

TABLE 9

## Event Analysis: Change in Branching Status

| Variable                | 2 years prior to switch | 2 years after switch | Change in Herfindahl        | Percent change in Herfindahl |
|-------------------------|-------------------------|----------------------|-----------------------------|------------------------------|
| Domestic deposits       | 264.96                  | 403.33               | 138.37 <sup>a</sup><br>4.50 | 81.78 <sup>a</sup><br>3.78   |
| Deposits due from banks | 789.67                  | 791.48               | 1.82<br>0.02                | 1.42<br>0.17                 |
| Deposits due to banks   | 828.22                  | 1436.55              | 608.32 <sup>a</sup><br>3.17 | 144.26 <sup>a</sup><br>3.27  |

a. Significant at the 1 percent level

SOURCE: Authors' calculations.

TABLE 10

## Regression Results

## Dependent Variable: HDEPIDOM

|                    | Model 1                                     | Model 2                                    | Model 3                                    | Model 4                                     |
|--------------------|---|--|--|---|
| Intercept          | 533.373<br>7.175                            | 607.623<br>7.987                           | 578.900<br>7.581                           | 338.734<br>3.402                            |
| Timedum            | -13.546 <sup>a</sup><br>-1.546 <sup>a</sup> | -6.202 <sup>b</sup><br>-0.698 <sup>b</sup> | -6.987 <sup>b</sup><br>-0.790 <sup>b</sup> | -12.697 <sup>b</sup><br>-1.424 <sup>b</sup> |
| HDOMDEP            | 1.022<br>26.267                             | 1.114<br>24.510                            | 1.028<br>18.796                            | 0.949<br>16.730                             |
| DSBRANCH           |   | -328.334<br>-3.839                         | -369.127<br>-4.277                         | -381.807<br>-4.457                          |
| HINTBDEP           |   |  | 0.061<br>2.815                             | 0.070<br>3.160                              |
| HAVGDMKT           |   |  |  | 0.108<br>3.854                              |
| Adj-R <sup>2</sup> | 0.512                                       | 0.522                                      | 0.527                                      | 0.527                                       |
| F-Value            | 348.217                                     | 241.887                                    | 185.302                                    | 145.451                                     |
| Prob >F            | 0   | 0  | 0  | 0   |

a. Significant at the 10 percent level.

b. Not significant.

NOTE: Unless otherwise noted, all coefficients are significant at the 1 percent level.

SOURCE: Authors' calculations.

after the event. We then tested to see if the change in the Herfindahls due to the change in branching status was significant. The results of the analysis are reported in table 9. For domestic deposits and correspondent deposits (deposits due to banks), a switch to more liberal branching significantly increases the Herfindahl; however, the change in the respondent

deposit (deposits due from banks) Herfindahl is not significant.

In all, univariate analysis of the data suggests that a relaxation of branching restrictions is associated with increased concentration in the market for domestic deposits and in the interbank deposit market. Neither of these results is surprising, as the removal of an artificial constraint to geographic consolidation of the banking system would be expected to increase concentration in banking markets. However, increased concentration does not necessarily translate into less competitive markets, as the removal of branching restrictions increases the potential for entry.

To separate the effects of branching status from deposit market concentration, we conduct a simple regression analysis—with the Herfindahl for correspondent deposits as the dependent variable. The results can be found in table 10. Model 1 regresses the correspondent deposit Herfindahl on the state-level Herfindahl for domestic deposits and a time dummy. Model 2 adds a statewide branching dummy variable (DSBRANCH = 1 for statewide branching, zero otherwise). A significant coefficient on DSBRANCH suggests that after controlling for the structure of the domestic deposit market, branching restrictions affect the structure of the correspondent banking market. Model 3 controls for the market concentration for respondent deposits. To the extent that there are scale and scope economies associated with the provision of correspondent banking services, increased concentration in respondent deposits may reduce the number of correspondent banks that can profitably operate in a market. Finally, model 4 extends the previous regression by including information on local market structure—HLOCDEP, the average local deposit market Herfindahl in each state. Inclusion of HLOCDEP allows us to control for the effect of local deposit market structure on correspondent banking.

The coefficient on the domestic deposit Herfindahl (HDOMDEP) is positive and significant from zero in all four models. In addition, the coefficient on the proxy for local deposit market structure (HLOCDEP) in model 4 is also positive and significant. This confirms the univariate results that find increased deposit market concentration associated with increased concentration in correspondent deposit markets. The negative and significant coefficient on DSBRANCH in models 2, 3, and 4 suggests that once domestic deposit market concentration is controlled for, relaxing branching restrictions leads to less concentrated and more

competitive correspondent banking markets. Finally, the positive and significant coefficient on the respondent deposit Herfindahl (HINTBDEP) index is consistent with the hypothesis that a reduction in the number of respondent banks reduces the number of correspondents that can coexist in a market—and hence increases concentration of correspondent deposits.

## V. Conclusion

Interstate branching promises to change the competitive landscape in banking. As illustrated by the mega-mergers of 1998—which included the merger of Bank of America and NationsBank—geographic consolidation of the banking system is well under way. This consolidation will certainly increase the concentration of deposit markets at the national and regional level. Moreover, the preceding analyses suggest that interstate consolidation may even increase deposit market concentration at the state and local level.

The evidence presented here indicates that intrastate branching deregulation and the subsequent geographic consolidation of the banking industry has led to increased concentration in the correspondent and respondent deposit markets. However, this increased concentration in the interbank market appears to be a consequence of increased concentration in the domestic deposit market associated with more liberal branching rights. Controlling for the level of concentration in the domestic deposit market, the effect of statewide branching is to reduce concentration in the correspondent deposit market. This result is consistent with the hypothesis that any positive effects of increased contestability of interbank markets resulting from the removal of branching restrictions mitigate (and may dominate) any negative effects on competition from increased concentration in interbank markets.

Overall, the evidence presented here suggests that interstate branching will result in more concentrated interbank markets, as the geographic consolidation of the banking industry at the national level will certainly reduce the number of correspondent and respondent banks nationwide. This increased concentration in correspondent banking markets will not necessarily reduce the competitiveness of these markets at the state and local level because branching deregulation also increases their contestability.

There are several caveats to these results: First, data limitations preclude our controlling

for important nonbank competitors in the correspondent banking market such as banker's banks, private clearinghouses, data processing firms, and the Federal Reserve Banks. Second, to the extent that banking organizations use the multibank holding company to circumvent branching restrictions, the measured impact of branching deregulation on market concentration and contestability will be overstated.

From a public-policy standpoint, if interstate branching leads to the establishment of truly national correspondent banks, then there may be less justification for the Federal Reserve System to provide correspondent banking services. However, more work needs to be done in this area before we can begin to seriously reconsider the role that Federal Reserve Banks play in this market.

## Appendix

### Loan Participations, Federal Reserve Membership, and Other Determinants of Correspondent Balances

Early literature indicates that loan participations are the second-most important service offered by correspondents. However, information about this activity is not available on the periodic reports submitted by banks. Knight (1970b) reports that 75 percent of banks experiencing an increased need for loan assistance cited the size of the loan as the main factor. The percentage of banks requiring loan assistance increased with bank size, and requirements for assistance are positively related to the loan-to-deposit ratio, the latter possibly indicating the importance of liquidity constraints. Knight (1970a) indicates that although most loan participations originate with the smaller banks, banks that do not experience excess loan demands can still buy loans or participations from their correspondents. Many respondents maintained credit lines or borrowed directly from their correspondents.

The correspondent services offered by the Federal Reserve System to its member banks have differed somewhat from those offered by private correspondents, and this has been a subject of contention and regulatory reform. Access to the discount window is probably the most obvious correspondent service that at some time might have been available only to members.

Federal Reserve membership has been identified as an important factor by several authors. The two reasons most often cited for nonmember banks being more likely to use correspondent services were the possibility that states with reserve requirements would allow nonmembers to count balances due as reserves, and the granting of immediate credit by correspondents for cash letters received from respondents. Lawrence and Lougee (1970) found that balances due from banks, but not the number of correspondent ties or their geographical distribution, is related to Fed membership. Member banks have higher balances due if balances at the Fed are included, but not if they are excluded. Knight (1970a) confirms this finding and also reports that the benefits of Fed membership appear to increase with bank size since, unlike overall banks, nonmember banks over a certain (small) size have correspondent balances that increase with bank size. Knight (1970a) reported that about 90 percent of banks surveyed preferred to send checks drawn on nonlocal banks through correspondents rather than the Fed, apparently because immediate credit was offered by the former. Although larger banks appear to have a greater preference for using the Fed, this could be misleading if correspondents send checks received from smaller banks on to the Fed for clearing.

Summers and Segala (1979) focus on the determinants of usage of Fed correspondent services. They find that bank size, holding-company affiliation, and metropolitan location increase the probability of a bank using Fed check-clearing services. However, only bank size affected usage of Fed wire services. Size is interpreted as indicating administrative capacity to manage the services.

Several other determinants of correspondent balances have been identified in the literature. For example, Lawrence and Lougee (1970) report that for banks in the Denver area, bank size, ratio of demand to total deposits, and distance of the bank from Denver are positively related to the amount of domestic "due from" balances. The number of correspondent ties is related to the first two characteristics. Meinster and Mohindru (1975) conclude that correspondent balances are influenced by liquidity considerations as well as the need to pay for correspondent services. The volatility of deposits is another factor: Kane (1982) found that suppliers of correspondent services imposed higher reserve requirements on more volatile deposits, a practice which is presumably consistent with volatility being related to the benefits derived from the services. Gilbert (1983) identifies a rela-

tionship between deposit volatility and the scale of correspondent services, with transaction cost being lowered by a larger number of respondents and thus a higher level of variability.

Geographic variables also play a role. Distance from the correspondent obviously is related to the cost of providing certain services, as well as familiarity with the correspondent. Size of city could, at times, be related to sophistication and consequently to the need for certain services.

## References

- Auerbach, Robert.** "Changes in the Provision of Correspondent-Banking Services and the Role of Federal Reserve Banks under the DIDMC Act: A Comment on Kane," *Carnegie-Rochester Conference Series on Public Policy*, vol. 16 (Spring 1982), pp. 127–36.
- Baker, George, Robert Gibbons, and Kevin J. Murphy.** "Implicit Contracts and the Theory of the Firm," Harvard Business School, Working Paper No. 98-009, December 1997.
- Bauer, Paul W., and Gary D. Ferrier.** "Scale Economies, Cost Efficiencies, and Technological Change in Federal Reserve Payments Processing," *Journal of Money, Credit, and Banking*, vol. 28, no. 4 (November 1996), pp. 1004–39.
- Dunham, Constance.** "Commercial Bank Costs and Correspondent Banking," Federal Reserve Bank of Boston, *New England Economic Review* (September/October 1981), pp. 22–36.
- Finney, Katherine.** *Interbank Deposits: The Purpose and Effects of Domestic Balances, 1934–54*. New York: Arno Press, 1958.
- Flannery, Mark J.** "Correspondent Services and Cost Economies in Commercial Banking," *Journal of Banking and Finance*, vol. 7, no. 1 (March 1983), pp. 83–99.
- Gilbert, R. Alton.** "Economies of Scale in Correspondent Banking," *Journal of Money, Credit, and Banking*, vol. 15, no. 4 (November 1983), pp. 483–88.

- Kane, Edward J.** "Changes in the Provision of Correspondent-Banking Services and the Role of Federal Reserve Banks under the DIDMC Act: Rejoinder," *Carnegie-Rochester Conference Series on Public Policy*, vol. 16 (Spring 1982), pp. 93–126.
- Knight, Robert E.** "Correspondent Banking Part I: Balances and Services," Federal Reserve Bank of Kansas City, *Monthly Review* (November 1970a), pp. 3–14.
- . "Correspondent Banking Part II: Loan Participations and Fund Flows," Federal Reserve Bank of Kansas City, *Monthly Review* (December 1970b), pp. 12–24.
- . "Correspondent Banking Part III: Account Analysis," Federal Reserve Bank of Kansas City, *Monthly Review* (December 1971), pp. 3–17.
- . "The Impact of Changing Check Clearing Arrangements on the Correspondent Banking System," Federal Reserve Bank of Kansas City, *Monthly Review* (December 1972), pp. 14–24.
- Lawrence, Robert J., and Duane Lougee.** "Determinants of Correspondent Banking Relationships," *Journal of Money, Credit, and Banking*, vol. 2, no. 3 (August 1970), pp. 358–69.
- McAfee, R. Preston.** "The Effects of Vertical Integration on Competing Input Suppliers," Federal Reserve Bank of Cleveland, *Economic Review*, vol. 35, no. 1 (1999), pp. 2–8.
- Meinster, David R., and Rajesh K. Mohindru.** "The Determinants of the Demand for Correspondent Balances by Small and Medium Sized Banks," *Journal of Bank Research*, vol. 6, no. 1 (Spring 1975), pp. 25–34.
- Merrett, D. T.** "Global Reach by Australian Banks: Correspondent Banking Networks, 1830–1960," *Business History*, vol. 37, no. 3 (July 1995), pp. 70–88.
- Milgrom, Paul, and John Roberts.** *Economics, Organization and Management*. Englewood Cliffs, N.J.: Prentice-Hall, 1992.
- Moulton, Harold G.** *Principles of Money and Banking*. Chicago: University of Chicago Press, 1916.
- Redlich, Fritz.** *The Molding of American Banking: Men and Ideas*. History of American Business Leaders Series, vol. 2. New York: Hafner Publishing Company, 1951.
- Summers, Bruce J., and John P. Segala.** "Determinants of Correspondent Banking Relationships with the Federal Reserve System," Federal Reserve Bank of Richmond, Working Paper No. 79-1, March 1979.
- Thomson, James B.** "Interbank Exposure in the Fourth Federal Reserve District," Federal Reserve Bank of Cleveland, *Economic Commentary*, August 1, 1987.
- Todd, Walker F., and James B. Thomson.** "An Insider's View of the Political Economy of the Too Big to Let Fail Doctrine," *Public Budgeting and Financial Management: An International Journal*, vol. 3, no. 3 (1991), pp. 547–617.
- Williamson, Oliver E.** *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: The Free Press, 1985.