

# Deregulation, Correspondent Banking, and the Role of the Federal Reserve

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Intrastate branching deregulation allowed correspondent banks to enter downstream retail deposit markets. Integrated correspondent banks may engage in vertical foreclosure, raising prices to downstream rivals or extracting valuable competitive information. The Federal Reserve would then tend to gain market share from private correspondent banks. Deregulation of restrictions on the formation of multibank holding companies, in contrast, allowed other correspondents to enter, increasing competition. We test these hypotheses using a panel data set of respondent account balances. We find that the Federal Reserve became a more important supplier of correspondent services following branching deregulation and that market power in the correspondent market declined following multibank holding company deregulation. *Journal of Economic Literature* Classification Numbers: D43, G21, G28, L11 © 2002 Elsevier Science (USA)

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## 1. INTRODUCTION

As is well known, the Federal Reserve is both a regulator of banks and a provider of banking services. It is natural to expect interaction between these roles, which may have potentially important implications. How has the Federal Reserve's dual role as regulator and provider of banking services affected the political economy of banking deregulation? We address this question by testing how the Federal Reserve's role as a provider of correspondent banking services changed following the deregulation of geographical branching restrictions.

The U.S. banking industry has long been highly decentralized. Geographical branching restrictions, both within and across states, as well as restrictions on bank ownership across states, largely account for this highly disaggregated industrial structure. Partly as a result of the disaggregated nature of the U.S. banking industry, correspondent banks have been an integral part of the process of facilitating transactions among different banks. Correspondents assist their customer banks—respondent banks—by processing checks to be collected by the respondent, processing other payments, and participating in loans originated by the respondent bank, among other tasks.

In recent years, deregulation has largely removed the geographical branching and banking restrictions that had impeded both consolidation and the ability of banks to offer their services over a wider area. Branching deregulation has also allowed correspondent banks to acquire banks (or branches) or to branch into new markets, making it possible for integrated correspondent-retail banks to raise their rivals' costs. This strategy, however, may be thwarted by the Federal Reserve Banks' willingness to provide check clearing and other services at cost. If the integrated firm does attempt to foreclose its rivals through higher costs or through lower quality services, the retail banks may shift their demand for correspondent services to Federal Reserve Banks.

In addition to deregulation of restrictions on branching, multibank holding company deregulation has opened the possibility for correspondent bank holding companies to expand both within and across state lines. This series of deregulatory moves provided potential competition to incumbent correspondent banks from other large banking organizations. The possibility of entry by other potential correspondent banks should encourage more competitive behavior of incumbent correspondents, even if the structure of the market remains concentrated.

This history of deregulation suggests that the dual role of the Federal Reserve as a regulator and a provider of banking services did affect the political economy of banking deregulation. To understand specifically how this effect was manifested, we empirically address the question of whether the advent of deregulation of bank branching restrictions was associated with a shift in respondent balances from private correspondent banks to Federal Reserve Banks. In our tests, we control for time trends, reserve requirements, bank size, the general decline in deposits, and other factors. We also test for the effects of multibank holding company deregulation that allows large bank holding companies to enter correspondent markets (from

both within the correspondent's state and from other states), thereby increasing the potential number of banks in a state capable of supplying correspondent services.

Our results support the idea that retail banks shifted their correspondent demand from private banks to the Federal Reserve as statewide branching deregulation occurred. The Federal Reserve Banks' share of respondent deposits rose as branching deregulation proceeded, especially in states with high concentration in the correspondent market. In addition, the shift to the Federal Reserve Banks was more pronounced for states with more small banks, consistent with the idea that these banks were most likely to be at risk from policies of integrated rivals. In contrast, consistent with the view that multibank holding company deregulation increased competition by lowering barriers to entry into the correspondent business, concentration in the correspondent market became much less important in explaining the Fed's share after deregulation of expansion by both in-state and out-of-state multibank holding companies.

These results illuminate important aspects of the role of the Federal Reserve Banks in the banking market. First, after the removal of branching restrictions, small banks faced the threat that large banks would open branches in markets that were previously available to them only through correspondent relationships. By integrating into a retail (downstream) market, a bank with significant market power in the correspondent (upstream) market could seek to disadvantage its rivals by raising their costs. If successful, such a strategy would result in lower profits and market share for small banks, threatening their viability. Our analysis suggests, however, that large banks were impeded in their deployment of this strategy by the ability of small banks to obtain services from Federal Reserve Banks. Consequently, small banks' concerns about potential competition from larger banks entering their markets was dissipated, which led them to lower their resistance to the removal of branching restrictions. We conclude therefore that it was the Federal Reserve Banks' role as a provider of correspondent services that helped facilitate the successful deregulation of the U.S. banking industry (see Kroszner and Strahan, 1999, for evidence consistent with this interpretation). Second, if correspondent markets continue to become more concentrated, access to Federal Reserve Bank correspondent services might become more valuable to unintegrated retail banks. The market share of the Federal Reserve Banks for unintegrated retail bank correspondent demand could rise over time.

The next section of the paper describes in more detail correspondent banking and the incentives vertically integrated firms have to raise rivals cost. This leads to a discussion of the main hypothesis of the paper and a review of our empirical approach. We report the results in Section 3 and discuss our conclusions in the last section.

## 2. CORRESPONDENT BANKING AND VERTICAL FORECLOSURE

### *Correspondent Banking*

Correspondent banks provide an array of services to their retail-bank customers (also known as respondent banks). These services include payment processing,

which largely consists of processing and transportation of checks to be collected; preparing and submitting electronic files for other payment systems, such as Fedwire or automated clearing house payments; helping to broker Fed funds purchases and sales; participating in loans; and providing foreign exchange services and other services. Notably, correspondents usually extract payment for their services by requiring respondents to hold non-interest-bearing account balances at the correspondent bank (Flannery, 1983; Osterberg and Thomson, 1999).

Correspondent banking is a relatively concentrated part of the banking industry. Gilbert (1983) examines four relatively wide market areas, consisting of at least a state each, and reports four-firm concentration ratios between 79 and 99%. Osterberg and Thomson (1999) calculate state-level Hirschmann–Herfindahl indices (HHI) for both correspondent (due-to) and respondent (due-from) balances of banks and find that they are higher than for state-level deposit HHIs.

Studies of correspondent banking have focused on the cost structure of banks, taking into account the costs of correspondent services, as in Dunham (1981) and Flannery (1983). Gilbert (1983) measures the economies of scale in correspondent banking arising from the reduction in variability of the correspondent account balances as the number of respondents rise, and he finds significant economies of scale using this measure.

Osterberg and Thomson (1999) examine the deregulation of banking and its impact on concentration in correspondent banking. They report that correspondent banking markets have become increasingly concentrated over time. They also find that, after controlling for local banking market concentration and other variables, states that allowed statewide branching during the period 1984–1996 had less concentrated correspondent banking markets. They interpret this finding as being consistent with increased contestability of correspondent banking markets as deregulation allowed for the possibility of entry by other correspondents.

Prior to the passage of the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA), the Federal Reserve Banks had offered correspondent services to members free of explicit charge. Members had to hold reserves at the Federal Reserve Banks. As the 1970s progressed, the high levels of inflation and nominal interest rates increased the opportunity cost of Federal Reserve membership and formed the background for the passage of DIDMCA. After DIDMCA, Federal Reserve Banks were required to offer many of its basic correspondent services, such as check collection and Fedwire services, to any banks at explicit prices which recovered full cost. Reserve requirements were extended to all banks at the same time.

Banks utilizing Federal Reserve correspondent services also can choose to hold required clearing balances with the Federal Reserve Banks. Banks who do so receive earnings credit that reduce explicit fees. These required clearing balances assist banks in avoiding overnight overdrafts at the Fed and are measured on a 2-week average basis, much like reserve balances. As retail sweep accounts have reduced the level of deposits subject to reserve requirements, many banks have substituted required clearing balances to manage their accounts with the

Fed, in much the same way that correspondent balances are used with a private correspondent (details can be found in Edwards (1997) and Stevens (1993)).

As a result of DIDMCA, the Federal Reserve's services have become a close substitute for private correspondent services. However, partially because of explicit pricing of services at the Federal Reserve Banks (versus implicit or bundled pricing of services by most correspondents), many banks still face higher costs at the margin using a Federal Reserve Bank than using a private correspondent bank. Perhaps more important are the inflexible rules under which they may manage their reserve accounts. Use of Reserve Bank services generates debits and credits to reserve accounts of banks, but banks are expected to avoid overnight overdrafts in those accounts. There are restrictions on the frequency of borrowing from the discount window as well. These issues are discussed in Gilbert (1977, 1980). Other reasons that a bank may prefer to use a private correspondent include the costs and complexity of maintaining the expertise and equipment to manage the different types of payments and possibly because of locational advantages of the correspondent. In general, smaller banks tend to use private correspondents more frequently than larger banks, as pointed out by Clair *et al.* (1995).

In addition to correspondent banks, banks can clear and process checks for collection through check clearinghouses. A clearinghouse arrangement is most often used by banks in urban areas. The costs of transportation are relatively low and symmetric for the members of clearinghouses in small geographical areas, such as cities. After the passage of DIDMCA, many clearinghouses were created to avoid the explicit charges imposed for check clearing by the Federal Reserve Banks, as reported in Kane (1982).

The high concentrations in correspondent banking at the regional level are indicative of local economies provided by transportation networks. As a result, locally dominant correspondents are likely to enjoy some cost advantages relative to correspondents whose transportation networks are sparse in the region. Because of the potential cost advantages at the local level that dominant correspondents possess, as well as the concentration of correspondent banking, it is likely that correspondents maintain some degree of market power.

### *Vertical Foreclosure*

Banking deregulation occurred both at the state and at the national levels (we review the sequence of these events carefully in the next section of the paper). Within states, branching restrictions were liberalized throughout the 1970s and 1980s (see Jayaratne and Strahan, 1998). Restrictions on branching across state lines were removed later in the 1980s and in the 1990s, culminating in the national deregulation in 1997. These liberalizations on bank ownership and branching not only allowed banks to expand horizontally, but also allowed correspondent banks to expand vertically into retail banking markets. While Gilbert, for example, analyzed correspondent banking market concentration at the level of the state or two states, most retail banking markets are considered to be much smaller in geographic

scope, comprising a metropolitan statistical area (MSA), or a county.<sup>2</sup> As a result, a typical correspondent bank that had been subject to intrastate branching restrictions prior to deregulation participated directly in few of the retail markets in which it provided upstream services. After liberalization of the intrastate branching restrictions, on the other hand, the correspondent had more opportunities to become vertically integrated by buying retail banks or branching into the retail markets it served.

As the correspondent branches into one of its retail markets, two incentives come into play. First, to the extent that there is imperfect competition both at the correspondent level and at the retail level of banking, the integrated correspondent-retail bank has an incentive to lower the prices of its combined services to its retail customers. This incentive arises because with imperfect competition at both levels of the banking market, prices exceed marginal costs at both levels. The integrated firm can expand output and increase profits by reducing the sum of the profit margin at both levels. If correspondent banks utilized linear pricing, and cannot discriminate its pricing between its downstream subsidiaries and other banks, then it is possible that prices at the correspondent level would fall as a result of widespread vertical integration. However, as reported in Phoenix-Hecht's *Blue Book* (2000), banks regularly discount prices to their largest corporate customers, employing effective price discrimination. It is likely that correspondents discriminate among respondents as well, as respondents impose different costs and have different demand for services. With discriminatory pricing, correspondents have the incentive to raise their retail rivals' costs under some circumstances.

Here it is important to distinguish between branching deregulation and deregulation of restrictions on multibank holding companies. If a correspondent may branch into a market, then the internal transfer price that it charges its branch is hidden from competitors, the Internal Revenue Service, and competition authorities. As a consequence, price discrimination by a correspondent against rival respondent banks is more easily accomplished than if the correspondent must set up an affiliate bank to enter the respondent's market. As pointed out by Bergman (2000) and Economides (1999), price or quality discrimination by an upstream monopolist does not generally result in higher profits if its own downstream affiliate must suffer the discrimination along with the rest of the downstream market. If the upstream supplier can discriminate selectively, only against nonaffiliated downstream customers, such discrimination raises the rivals' costs and can increase profits.

A brief review of a general model of such a price squeeze is useful at this point. We follow the model of Hart and Tirole (1990), but another similar model is presented by Salinger (1988). Ordover *et al.* (1990) present a complementary model that derives other conditions under which we could expect such a price squeeze, which is generally called *vertical foreclosure*. In the model of Hart and

<sup>2</sup> Recent evidence suggests that banking markets are becoming more geographically dispersed. See Radecki (1998), Mishkin and Strahan (1999), and Petersen and Rajan (2001).

Tirole, both the upstream and downstream markets are duopoly markets. There are constant returns to scale in all the firms, and the firms in each market segment produce perfect substitutes. Consider the case in which the downstream firms set output according to Cournot behavior, and the upstream firms sell their output according to Bertrand behavior. In a situation in which one upstream firm has lower costs than the other firm, the lower-cost upstream firm sells to both firms. Hart and Tirole do not restrict the nature of the contracts between the firms. As a result, in contrast to the standard Bertrand case in which the upstream price is set at the level of the cost of the higher cost firm, in their model the firms contract for the intermediate good at the lower cost. The downstream firms then share profits with the upstream supplier. This is done to avoid the inefficiency of setting the price of the intermediate good at a level above the supplier's marginal cost, and the result is an efficient supply of output by the industry (subject to the Cournot output of the downstream industry).

In the case in which the lower-cost supplier integrates with one of the downstream firms, its incentives are now changed. While it continues to supply its downstream affiliate at the low marginal cost, it supplies its rival at the higher level of cost of its upstream rival supplier. Its incentives, now aligned with restricting the output of the rival firm, guide it to raise prices to it to the extent that is feasible. This is true even in the context of possible profit-sharing contracts.

It is also worth noting that the incentives to raise downstream rivals' costs can exist even in more competitive downstream industries. These incentives can be a result of attempting to reduce the demand for upstream services and therefore make entry into the upstream market less attractive. Salinger (1988) derives conditions under which the derived demand by unaffiliated firms for the intermediate good falls as a result of vertical foreclosure. With fixed cost of entry upstream, the incentives to enter the market at the upstream level are reduced.

One important feature of the models just discussed is that the downstream firms that suffer the higher prices nonetheless remain customers of the upstream discriminatory firm. This result can be regarded as a *corner solution*, reflecting the specific assumptions of the models. For example, if the downstream firms have different costs of accessing an outside supplier (e.g., the Fed), but the upstream firm is not able to discern which of the downstream firms is more likely to avail itself of the outside supplier, then it would still be profitable for the downstream firm to raise its rivals' cost, even though it would lose some business at the margin. Alternatively, if there is a fixed cost to access an outside supplier, the upstream firm may be motivated to engage in a vertical price squeeze that would drive downstream firms to the alternative supplier if it is interested in deterring entry into the downstream market. An entrant would face either the higher costs of using the upstream firm for service or would have to expend the fixed costs to access the alternative supplier, which would make entry less attractive.

Another important consideration for respondent banks is safeguarding information about one's customers. When its correspondent is precluded from entering its

market, it need not be concerned about the strategic value of the information that can be gained from observing the transactions that flow through the correspondent account. However, when the correspondent enters its market, the respondent bank may be reluctant to reveal that information. Simply observing the volume of activity by different business customers may convey important information to the correspondent about which customers to pursue as it enters a respondent's market.<sup>3</sup> Because of this concern, a respondent may wish to switch to an alternative supplier even if its correspondent does not attempt a price squeeze.<sup>4</sup>

How likely is it that integrated correspondent-retail banks would actually be motivated to raise their rivals' costs or misuse information? According to commentary provided to the Committee on the Federal Reserve in the Payments Mechanism, Federal Reserve System (1998), many community banks and other small depository institutions expressed concern that consolidation of the banking industry would lead to fewer choices of check service providers and that "withdrawal of active correspondent banks. . . has been reported in some local markets" (p. 21). Furthermore, they were also concerned that "these competitors could derive proprietary competitive information about community banks' customers from their correspondent activities" (p. 21). And they reported that "prices would rise if the Federal Reserve were to withdraw from the check collection market, but attribute these increases to the market power that the remaining check collection providers would have following the Federal Reserve's exit" (p. 22). These statements appear largely consistent with the possibility that integrated correspondent-retail banks would be motivated to vertically foreclose their retail rivals. Some banks are clearly concerned about absolute foreclosure, increased prices, and unfair use of information gained from correspondent activity.

### 3. EMPIRICAL METHODS AND RESULTS

#### *A Brief History of Restrictions on Bank Expansion*

Restrictions on bank branching were initially imposed by the states in the nineteenth century and had been supported for many years by small and inefficient banks as a way to inhibit competition from other banks.<sup>5</sup> Although there was some

<sup>3</sup> Mester *et al.* (1998) explore the possibility that a bank gains valuable information about its customers through their checking account activity. To merely observe the volume of checks and dollar values to indicate active, and therefore, potentially profitable accounts, requires a lower level of information to be revealed by transaction activity.

<sup>4</sup> This concern could lead a respondent to migrate to the Fed in the case in which the private correspondent engaged in a price squeeze only on those correspondent services not provided by the Fed.

<sup>5</sup> Economides *et al.* (1996) show, for instance, that states with many weakly capitalized small banks supported the 1927 McFadden Act, which gave states the authority to regulate national banks' branching powers. Kroszner and Strahan (1999) show that states dominated by small banks deregulated restrictions on branching later than other states. Kane (1996) also emphasizes the effects of bank failures in raising awareness about the higher risk that comes with a less well-diversified banking system.

deregulation of these branching restrictions in the 1930s, most states either prohibited or limited branching until the 1970s, when only 12 states allowed unrestricted statewide branching. Between 1970 and 1994, however, 38 states deregulated their restrictions on branching, first by allowing banks to purchase existing branches (or banks) and then later by allowing them to open new (*de novo*) branches. We call this first form of deregulation *branching by M&A* and the second unrestricted branching.

While intrastate branching was generally restricted, many states allowed banking companies to expand by forming multibank holding companies (MBHCs). The 16 states that did not permit MBHCs in the early 1970s relaxed these restrictions over the subsequent 20 years. In addition to facing restrictions on within-state expansion, the Douglas Amendment to the 1956 Bank Holding Company Act prohibited a BHC from acquiring banks outside the state where it was headquartered unless the target bank's state permitted such acquisitions. Because no state allowed such transactions in 1956, the amendment effectively barred interstate banking organizations. States had the option to allow out-of-state BHCs to enter, but none exercised it until 1978, when Maine permitted such transactions. As part of the Garn–St Germain Act, federal legislators in 1982 amended the Bank Holding Company Act to allow failed banks and thrifts to be acquired by any bank holding company, regardless of state laws (Kroszner and Strahan, 1999). Many states then entered regional or national reciprocal arrangements whereby their banks could be bought by any other state in the arrangement.

Table I chronicles the steps taken by individual states to eliminate geographic restrictions. The first two columns pertain to branching and the last two pertain to holding company deregulation. The first column presents the year in which each state permitted branching by means of merger and acquisition (M&A) only. The second column reports the year in which each state first permitted unrestricted branching, thereby allowing banks to enter new markets by opening new branches.<sup>6</sup> In most cases, branching by M&A occurred first, and then unrestricted branching deregulation occurred soon thereafter. Column 3 reports the year in which the states permitted multibank holding companies, and Column 4 reports the year in which states entered into an interstate banking agreement with other states, thereby allowing holding companies from out-of-state to buy their banks.

### *Hypotheses*

The discussion in Section 2 suggests our two main hypotheses. First, we argue that bank branching deregulation led to the potential for more vertical integration of correspondent and retail banks, thereby allowing integrated banks to engage in vertical foreclosure or misuse of sensitive customer information. Our data, however, are too limited to allow direct tests of this hypothesis. In particular, most

<sup>6</sup> In most cases, the dates selected reflect the time at which the state finished the branching deregulation process. See Amel (1993) and Jayaratne and Strahan (1998) for details.

TABLE I  
Year of Deregulation of Restrictions on Geographical Expansion, by State

| State          | Intrastate<br>branching<br>by M&A | Unrestricted<br>intrastate branching<br>permitted | State multibank<br>holding companies<br>permitted | Interstate multibank<br>holding companies<br>permitted |
|----------------|-----------------------------------|---------------------------------------------------|---------------------------------------------------|--------------------------------------------------------|
| Alabama        | 1981                              | 1990                                              | <1970                                             | 1987                                                   |
| Alaska         | <1970                             | <1970                                             | <1970                                             | 1982                                                   |
| Arizona        | <1970                             | <1970                                             | <1970                                             | 1986                                                   |
| Arkansas       | 1994                              | — <sup>a</sup>                                    | 1985                                              | 1989                                                   |
| California     | <1970                             | <1970                                             | <1970                                             | 1987                                                   |
| Colorado       | 1991                              | — <sup>a</sup>                                    | <1970                                             | 1988                                                   |
| Connecticut    | 1980                              | 1988                                              | <1970                                             | 1983                                                   |
| Delaware       | <1970                             | <1970                                             | <1970                                             | 1988                                                   |
| DC             | <1970                             | <1970                                             | <1970                                             | 1985                                                   |
| Florida        | 1988                              | 1988                                              | <1970                                             | 1985                                                   |
| Georgia        | 1983                              | — <sup>a</sup>                                    | 1976                                              | 1985                                                   |
| Hawaii         | 1986                              | 1986                                              | <1970                                             | 1997                                                   |
| Idaho          | <1970                             | <1970                                             | <1970                                             | 1985                                                   |
| Illinois       | 1988                              | 1993                                              | 1982                                              | 1986                                                   |
| Indiana        | 1989                              | 1991                                              | 1985                                              | 1986                                                   |
| Iowa           | — <sup>a</sup>                    | — <sup>a</sup>                                    | 1984                                              | 1991                                                   |
| Kansas         | 1987                              | 1990                                              | 1985                                              | 1992                                                   |
| Kentucky       | 1990                              | — <sup>a</sup>                                    | 1984                                              | 1984                                                   |
| Louisiana      | 1988                              | 1988                                              | 1985                                              | 1987                                                   |
| Maine          | 1975                              | 1975                                              | <1970                                             | 1978                                                   |
| Maryland       | <1970                             | <1970                                             | <1970                                             | 1985                                                   |
| Massachusetts  | 1984                              | 1984                                              | <1970                                             | 1983                                                   |
| Michigan       | 1987                              | 1988                                              | 1971                                              | 1986                                                   |
| Minnesota      | 1993                              | — <sup>a</sup>                                    | <1970                                             | 1986                                                   |
| Mississippi    | 1986                              | 1989                                              | 1990                                              | 1988                                                   |
| Missouri       | 1990                              | 1990                                              | <1970                                             | 1986                                                   |
| Montana        | 1990                              | — <sup>a</sup>                                    | <1970                                             | 1993                                                   |
| Nebraska       | 1985                              | — <sup>a</sup>                                    | 1983                                              | 1990                                                   |
| Nevada         | <1970                             | <1970                                             | <1970                                             | 1985                                                   |
| New Hampshire  | 1987                              | 1987                                              | <1970                                             | 1987                                                   |
| New Jersey     | 1977                              | — <sup>a</sup>                                    | <1970                                             | 1986                                                   |
| New Mexico     | 1991                              | 1991                                              | <1970                                             | 1989                                                   |
| New York       | 1976                              | 1976                                              | 1976                                              | 1982                                                   |
| North Carolina | <1970                             | <1970                                             | <1970                                             | 1985                                                   |
| North Dakota   | 1987                              | — <sup>a</sup>                                    | <1970                                             | 1991                                                   |
| Ohio           | 1979                              | 1989                                              | <1970                                             | 1985                                                   |
| Oklahoma       | 1988                              | — <sup>a</sup>                                    | 1983                                              | 1987                                                   |
| Oregon         | 1985                              | 1985                                              | <1970                                             | 1986                                                   |
| Pennsylvania   | 1982                              | 1990                                              | 1982                                              | 1986                                                   |
| Rhode Island   | <1970                             | <1970                                             | <1970                                             | 1984                                                   |
| South Carolina | <1970                             | <1970                                             | <1970                                             | 1986                                                   |
| South Dakota   | <1970                             | <1970                                             | <1970                                             | 1988                                                   |
| Tennessee      | 1985                              | 1990                                              | <1970                                             | 1985                                                   |
| Texas          | 1988                              | 1988                                              | 1970                                              | 1987                                                   |
| Utah           | 1981                              | 1981                                              | <1970                                             | 1984                                                   |
| Vermont        | 1970                              | 1970                                              | <1970                                             | 1988                                                   |
| Virginia       | 1978                              | 1987                                              | <1970                                             | 1985                                                   |
| Washington     | 1985                              | 1985                                              | 1981                                              | 1987                                                   |
| West Virginia  | 1987                              | 1987                                              | 1982                                              | 1988                                                   |
| Wisconsin      | 1990                              | 1990                                              | <1970                                             | 1987                                                   |
| Wyoming        | 1988                              | — <sup>a</sup>                                    | <1970                                             | 1987                                                   |

Source: Amel (1993) and Kroszner and Strahan (1999).

<sup>a</sup> States not yet deregulated.

entry in markets is via branching, which is difficult to observe. In addition, we do not have data on prices charged by correspondents. Since the data we have will not allow a direct test of that hypothesis, we examine a related one: we test whether unintegrated retail banks (the presumptive targets of a price squeeze) shift business to the Federal Reserve Banks following branching deregulation. We emphasize branching deregulation in our test for vertical foreclosure because this type of deregulation allows correspondents to enter their downstream customers' markets. In addition, private correspondent banking is more likely to have been an important source of upstream services to retail banks in states with significant branching restrictions prior to deregulation. Correspondents are also more likely to engage in a price squeeze against smaller banks. Larger banks are more likely to be customers of the Federal Reserve Banks directly, and smaller banks may have significant costs to access either the Federal Reserve Banks or other private correspondent banks.

Our second main hypothesis concerns the effects of deregulation at the holding company level, both within and across state lines. Like branching, deregulation of prohibitions on multibank holding companies does allow banking companies to enter new markets. But this kind of deregulation does not, in the absence of the ability to branch, allow banks affiliated with a large holding company to be rolled up into the organization. Thus, as we argued above, it may be difficult or impossible for correspondent banks to vertically foreclose their rivals because attempts to do so would be transparent to competing banks, regulators, and tax collectors. Moreover, by allowing banking companies to build larger networks of affiliated banks, holding company deregulation may increase competitiveness in the market for correspondent services, leading to a decline in concentration as a determinant of the importance of Fed-provided services.

To summarize, we test two hypotheses: first, we test whether deregulation of bank branching led banks to utilize the Federal Reserve to a greater extent for their correspondent business. Second, we test whether state multibank holding company (MBHC) deregulation and interstate banking deregulation increased the competitiveness of the private correspondent market, thereby reducing the Fed's role. In both cases, we expect these effects to be most important in states with relatively concentrated markets for correspondent banking.

### *Methods and Results*

We use state-level aggregated data from 1975 to 1997 from the Reports of Condition and Income (the "Call" Reports) provided by the Federal Reserve System. We construct state aggregates by summing the data across all banks operating in a state, so that the measures represent dollar-weighted average figures for all banks in the state. Our dependent variable is the share of total respondent deposits due from Federal Reserve Banks. That is, we compute the ratio of respondent deposits due from the Federal Reserve to respondent deposits due from commercial banks plus Federal Reserve Banks. We use respondent deposits, rather than correspondent

deposits, because respondent deposits are connected with the customer bank, while correspondent deposits are not.

One difficulty with the data on deposit balances at Federal Reserve Banks is that after 1984 the Call Report includes this information only for banks with assets above \$100 million. We deal with this discontinuity by creating the aggregate state-level variables for banks with assets above \$100 million (in 1984 dollars), both before and after 1984. This approach gives us a consistent series over time. To test whether this truncation affects our conclusions, we have also estimated the model for the 1975 to 1983 period using all banks. As shown in Appendix A, the coefficients are very similar for the two approaches; we therefore focus only on the longer panel in our main set of results.

### *Reduced Form*

We first report a set of reduced form equations to characterize how both the Fed's share of respondent balances and how the concentration of suppliers of correspondent services evolved in response to branching and MBHC deregulation. We use the Hirschmann–Herfindahl Index (the sum of squared market shares) of correspondent balances for all banks located in the state as our measure of concentration.

In the reduced form model, we focus on variables controlling for branching and MBHC deregulation. In addition to these, we include a set of state fixed effects to control for cross-state differences (e.g., population density) that might affect the demand for correspondent services both from the Fed and from the private sector and a set of time dummy variables to control for common factors such as changes in the level of interest rates and national regulatory innovations such as elimination of Regulation Q and passage of DIDMCA. We include personal income growth in the state and the required reserve ratio based on the total amount of each type of deposit in the state as additional control variables.

Our regulatory variables exploit the fact that states deregulated restrictions on branching and the ability to form MBHCs at different times. (This timing allows us to control for both state and time effects in the panel models.) To control for branching deregulation, we create two indicator variables based on the dates reported in Table I. The first, the intrastate branching by M&A indicator, equals one when a state permits this form of branching and zero when it does not. The second, the unrestricted branching indicator, equals one when a state permits banks to open new (*de novo*) branches anywhere in the state. For holding company deregulation, we also construct two indicators. The state multibank holding company indicator equals one when a state permits the formation of MBHCs within the state (i.e., all of the banks are chartered within the state). The interstate banking indicator equals one when a state permits bank holding companies from other states to buy their banks. We use the year in which a state initially entered into an interstate banking agreement with other states for this variable.

TABLE II  
Summary Statistics and Descriptions of Market, Bank, and Regulatory Variables

|                                                       | Mean  | Standard deviation |
|-------------------------------------------------------|-------|--------------------|
| Federal Reserve share of respondent balances          | 43.07 | 15.06              |
| Ratio of reserve requirement amount to total deposits | 2.99  | 0.91               |
| State level personal income growth                    | 2.42  | 3.11               |
| Intrastate branching by M&A indicator                 | 0.63  | 0.48               |
| State multibank holding companies indicator           | 0.90  | 0.31               |
| Unrestricted branching indicator                      | 0.47  | 0.50               |
| Interstate banking indicator                          | 0.50  | 0.50               |
| Correspondent Herfindahl index                        | 3064  | 1857               |
| <i>N</i>                                              | 1,127 | 1,127              |

*Note.* Variable Descriptions: The Fed market share equals balances due from Federal Reserve banks divided by the sum of balances due from Federal Reserve banks and balances due from depository institutions in the United States. The variable balances due from Federal Reserve Banks is available for all banks only until 1983. After 1983, it is only available for banks with assets greater than \$100 million. To create a consistent dataset, banks with assets less than \$100 million (1984 constant dollars) were dropped from the sample. Correspondent balances consist of deposits of commercial banks in the United States, deposits of banks in foreign countries, and deposits of foreign governments and official institutions. The reserve requirement amount is equal to the reserve requirement percentage multiplied by the amount of demand deposits subject to the reserve requirement. Before 1984, we calculated demand deposits subject to the reserve requirement as demand deposits minus cash items in process of collection and unposted debits, and non-interest-bearing balances due from commercial banks in the United States. From 1984 onward, we set this amount equal to total transaction accounts. Deregulation index is 0 if a state does not permit branching via M&A, *de novo* branching, or branching via the formulation of multibank holding companies; otherwise, the index is the sum of the number of ways banks may expand within the state. Interstate branching is 1 if the state permits interstate branching and 0 otherwise.

Table II reports summary statistics for the variables, and Table III reports the reduced form results. Column 1 of Table III shows a significant decline in the Fed's market share following state-level MBHC deregulation and a significant increase in the Fed's share following unrestricted branching deregulation. On its face, these results suggest that the Fed becomes more important after branching deregulation, consistent with vertical foreclosure, and less important following holding company deregulation, consistent with increased competition in the correspondent market.

Column 2 of Table III shows that concentration in the market for correspondent services declined after all four kinds of deregulation, although the decline is not statistically significant after branching by M&A. The declines are quantitatively large. For example, if we consider a state that began with no MBHCs and no branching that subsequently allowed both MBHCs and branching, the correspondent HHI would fall by about 1000 points. Following interstate banking, the HHI would fall by another 330 points. These regulatory effects, however, have been largely offset by a trend toward greater concentration, not only in banking as a whole, but in the market for correspondent services. As Fig. 1 shows, the average HHI increased quite dramatically during the 1990s.

TABLE III

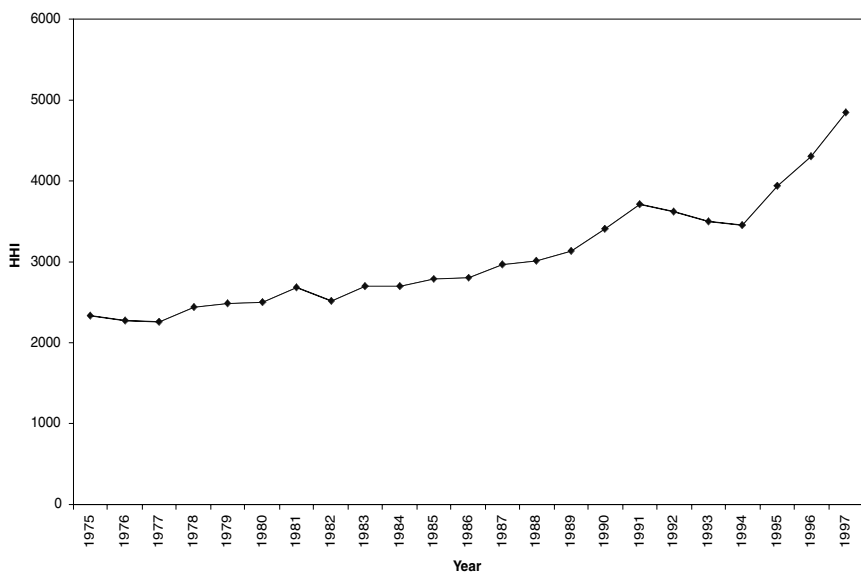
Reduced Form Relationship between Federal Reserve Share, Correspondent Concentration, and Deregulation (Standard Errors in Parentheses)

|                                                       | Federal Reserve<br>share<br>(1) | Correspondent<br>Herfindahl<br>(2) |
|-------------------------------------------------------|---------------------------------|------------------------------------|
| Ratio of reserve requirement amount to total deposits | 4.64**<br>(0.86)                | 286.93**<br>(80.38)                |
| State level personal income growth                    | -0.08<br>(0.14)                 | -16.50<br>(13.28)                  |
| Intrastate branching by M&A indicator                 | -1.95<br>(1.35)                 | -147.35<br>(126.76)                |
| State multibank holding companies indicator           | -3.55**<br>(1.51)               | -545.01**<br>(141.47)              |
| Unrestricted branching indicator                      | 5.55**<br>(1.41)                | -372.96**<br>(131.66)              |
| Interstate banking indicator                          | 1.69<br>(1.48)                  | -330.42**<br>(138.23)              |
| <i>N</i>                                              | 1,127                           | 1,127                              |
| <i>R</i> <sup>2</sup>                                 | 0.2268                          | 0.3494                             |

*Note.* All models have year- and state-fixed effects. All variables are in percentage terms, where applicable.

\*\* Statistically significant at the 5% level.

\* Significant at the 10% level.



**FIG. 1.** Herfindahl-Hirschman index of concentration in correspondent banking markets in the United States, 1975 to 1997.

TABLE IV

Relationship between Federal Reserve Share and Correspondent Concentration in Different Regulatory Regimes (Standard Errors in Parentheses)

|                                                                                         | Linear<br>specification<br>(1) | Specification with<br>interaction term<br>(2) |
|-----------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------|
| Ratio of reserve requirement amount to total deposits                                   | 4.18**<br>(0.85)               | 3.77**<br>(0.86)                              |
| State level personal income growth                                                      | -0.05<br>(0.14)                | -0.07<br>(0.14)                               |
| Intrastate branching by M&A indicator                                                   | -1.71<br>(1.34)                | -4.99*<br>(2.93)                              |
| State multibank holding companies indicator                                             | -2.67*<br>(1.51)               | 1.34<br>(3.70)                                |
| Unrestricted branching indicator                                                        | 6.15**<br>(1.40)               | 0.04<br>(2.60)                                |
| Interstate banking indicator                                                            | 2.22<br>(1.46)                 | 8.59**<br>(2.40)                              |
| Correspondent balances Herfindahl index                                                 | 0.0016**<br>(0.0003)           | 0.0024<br>(0.0017)                            |
| Correspondent balances Herfindahl index*<br>intrastate branching by M&A indicator       | —                              | 0.0016<br>(0.0010)                            |
| Correspondent balances Herfindahl index*<br>state multibank holding companies indicator | —                              | -0.0021<br>(0.0017)                           |
| Correspondent balances Herfindahl index*<br>unrestricted branching indicator            | —                              | 0.0019**<br>(0.0007)                          |
| Correspondent balances Herfindahl index*<br>interstate banking indicator                | —                              | -0.0020**<br>(0.0006)                         |
| <i>N</i>                                                                                | 1,127                          | 1,127                                         |
| <i>R</i> <sup>2</sup>                                                                   | 0.2441                         | 0.2582                                        |

*Note.* All models have year- and state-fixed effects. All variables are in percentage terms, where applicable.

\*\* Statistically significant at the 5% level.

\* Significant at the 10% level.

### *Evidence of Vertical Foreclosure*

To construct a more direct test for vertical foreclosure, we include the HHI for correspondent banks operating in the state as an explanatory variable (Table IV). If branching deregulation raises the possibility of vertical integration and hence vertical foreclosure, then the share of respondent deposits at Federal Reserve Banks ought to become more sensitive to concentration (latent market power) in the correspondent market after branching is permitted. The Fed share also ought to rise following branching deregulation as small banks move to the Fed, and this rise ought to be greatest in states with the high levels of concentration in correspondent banking. We test these ideas by interacting our branching deregulation variables

with the correspondent HHI. We also interact the holding company deregulation indicators with the HHI.

The regression results suggest that the share of respondent deposits held at Federal Reserve Banks increased after branching reform and that this increase was much larger in states with high concentration in the correspondent banking market, that is, in states where market power in correspondent banking would allow vertical foreclosure. For example, the regression coefficients in Table IV Column 2 suggest that when concentration was low (correspondent HHI of 2000), deregulation of branching (both forms—M&A and unrestricted) led to a small increase in the Fed's market share of 2 percentage points. When concentration was high (HHI of 4000), however, the Fed's market share increased by 9 percentage points.

We also test how bank holding company deregulation affected the relationship between the HHI and the Fed share. In contrast to branching, following holding company deregulation the impact of market concentration on the Fed's market share diminished. Thus, the impact of concentration in the correspondent market depends on the regulatory regime. When branching is deregulated but prohibitions on holding company expansion remain, concentration is strongly positively related to the Fed's market share. In this partially deregulated environment, a one standard deviation increase in concentration, and hence an increase in market power, raises the Fed share by 11 percentage points (again using the coefficients from Table IV). This large increase is perhaps unrealistic, however, because in almost every case states allowed MBHCs before they allowed branching. In the case of a state allowing MBHCs and unrestricted branching (but not interstate holding company expansion), a one standard deviation increase in concentration raises the Fed share by 7.4 percentage points.

These results point to the importance of the Fed in limiting the costs associated with vertical foreclosure in an environment where large correspondents can enter their downstream customers' markets, but remain protected from competition in the upstream market by prohibitions on interstate banking. Once those prohibitions were lifted, that is, once states deregulated their restrictions on interstate banking, the effects of the HHI again became much smaller.

Table V is an attempt to summarize the information from the regression estimates. The first part of the table calculates the partial derivative of the share of respondent balances due from the Federal Reserve with respect to concentration. We report these derivatives starting with the most constrained environment, one where expansion by both branching and holding companies was not permitted. We then first relax constraints on MBHCs within the state, second relax restrictions on branching, and third relax restrictions on interstate banking (i.e., cross-state MBHCs). This ordering is motivated by the actual history of deregulation (Table I).

In the fully regulated environment, concentration is only weakly related to the Fed's share, a finding consistent with a scenario similar to one provided by Hart-Tirole. The effect of HHI falls further after states permit MBHCs, reflecting

TABLE V

| A. Effect of concentration on Fed's share: $\frac{\partial \text{FedShare}}{\partial \text{HHI}}$<br>(calculated from coefficients in Table IV, Column 2) |            |            |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------|
| Fully regulated                                                                                                                                           |            |            | 0.002   |
| No branching                                                                                                                                              |            |            |         |
| No state multibank holding companies                                                                                                                      |            |            |         |
| No interstate banking                                                                                                                                     |            |            |         |
| Partial deregulation                                                                                                                                      |            |            | 0.0003  |
| No branching                                                                                                                                              |            |            |         |
| Allows state multibank holding companies                                                                                                                  |            |            |         |
| No interstate banking                                                                                                                                     |            |            |         |
| Partial deregulation                                                                                                                                      |            |            | 0.004** |
| Allows unrestricted branching                                                                                                                             |            |            |         |
| Allows state multibank holding companies                                                                                                                  |            |            |         |
| No interstate banking                                                                                                                                     |            |            |         |
| Full deregulation                                                                                                                                         |            |            | 0.002** |
| Allows unrestricted branching                                                                                                                             |            |            |         |
| Allows state multibank holding companies                                                                                                                  |            |            |         |
| Allows interstate banking                                                                                                                                 |            |            |         |
| B. Effect of deregulation on Fed's share<br>(calculated from coefficients in Table IV, Column 2)                                                          |            |            |         |
| Regulatory regime                                                                                                                                         | HHI = 2000 | HHI = 4000 |         |
| State multibanking holding company deregulation                                                                                                           | -2.9*      | -7.1*      |         |
| Unrestricted branching deregulation (starting from no branching)                                                                                          | 2.0        | 9.0**      |         |
| Interstate banking deregulation                                                                                                                           | 4.6*       | 0.6        |         |

\*\* Statistically significant at the 5% level.

\* Significant at the 10% level.

the potential to build large banking networks and more potential competition in the correspondent market. After statewide deregulation of intrastate branching, however, concentration becomes positively and significantly related to respondent deposits moving to the Fed. Finally, when interstate holding company restrictions fall, concentration again becomes less influential in affecting the shares of respondent deposits, although it remains statistically significant.

The second part of Table V examines how the various kinds of deregulation affected the share of respondent balances due from the Federal Reserve, evaluated at two levels of concentration (HHI of 2000 and HHI of 4000, about 1/2 of a standard deviation above and below the mean). This exercise shows that branching deregulation was positively related to the Fed's share of respondent deposits, particularly in concentrated markets. Holding company deregulation at the state-level was strongly negatively related to the Fed share in states with high concentration. Interstate banking deregulation, however, was also positively related to the Fed's share, but in markets that were less concentrated, and this effect falls to zero for levels of concentration above the mean concentration.

TABLE VI

Relationship between Federal Reserve Share and Correspondent Concentration in Different Regulatory Regimes, Accounting for Size of Banks (Standard Errors in Parentheses)

|                                                                                          | No bank<br>size control<br>(Column 2 from<br>Table IV)<br>(1) | Small banks<br>have assets<br>below state<br>median<br>(2) | Small banks<br>have assets<br>below national<br>median<br>(3) |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|
| Ratio of reserve requirement amount<br>to total deposits                                 | 3.77**<br>(0.86)                                              | 4.19**<br>(0.85)                                           | 3.75**<br>(0.85)                                              |
| State level personal income growth                                                       | -0.07<br>(0.14)                                               | -0.08<br>(0.14)                                            | -0.10<br>(0.14)                                               |
| Intrastate branching by M&A indicator                                                    | -4.99*<br>(2.93)                                              | -4.15<br>(2.88)                                            | -4.53<br>(2.89)                                               |
| State multibank holding companies indicator                                              | 1.34<br>(3.70)                                                | 2.76<br>(3.64)                                             | 2.60<br>(3.65)                                                |
| Unrestricted branching indicator                                                         | 0.04<br>(2.60)                                                | -1.94<br>(2.58)                                            | -1.42<br>(2.58)                                               |
| Interstate banking indicator                                                             | 8.59**<br>(2.40)                                              | 9.28**<br>(2.36)                                           | 7.59**<br>(2.37)                                              |
| Correspondent balances Herfindahl index                                                  | 0.0024<br>(0.0017)                                            | 0.0025<br>(0.0016)                                         | 0.0025<br>(0.0016)                                            |
| Correspondent balances Herfindahl index*<br>intrastate branching by M&A indicator        | 0.0016<br>(0.0010)                                            | 0.0008<br>(0.0010)                                         | 0.0008<br>(0.0010)                                            |
| Correspondent balances Herfindahl index*<br>state multibank holding companies indicator  | -0.0021<br>(0.0017)                                           | -0.0022<br>(0.0017)                                        | -0.0023<br>(0.0017)                                           |
| Correspondent balances Herfindahl index*<br>unrestricted branching indicator             | 0.0019**<br>(0.0007)                                          | 0.0026**<br>(0.0007)                                       | 0.0027**<br>(0.0007)                                          |
| Correspondent balances Herfindahl index*<br>interstate banking indicator                 | -0.002**<br>(0.0006)                                          | -0.0019**<br>(0.0006)                                      | -0.0017**<br>(0.0006)                                         |
| Share of bank assets held by banks whose asset<br>size is less than state median bank    | —                                                             | -0.61**<br>(0.10)                                          | —                                                             |
| Share of bank assets held by banks whose asset<br>size is less than national median bank | —                                                             | —                                                          | -0.28**<br>(0.05)                                             |
| <i>N</i>                                                                                 | 1,127                                                         | 1,127                                                      | 1,127                                                         |
| <i>R</i> <sup>2</sup>                                                                    | 0.2582                                                        | 0.2853                                                     | 0.2816                                                        |

\*\*Statistically significant at the 5% level.

\*Significant at the 10% level.

In Table VI we check the robustness of our results with respect to the inclusion of a measure of bank size in the regression. As we discussed, larger banks tend to utilize the Fed for services, so it might be that our results in Table IV largely reflect this correlation. In the estimates shown in Table VI (which include the estimate from Table IV, Column 2 for comparison), we have included bank size as measured by the percentage of the state's banking assets held by banks smaller than the median size of banks in that state (Column 2) or smaller than the median size of banks in the nation (Column 3). While we confirm that this variable is significant,

TABLE VII

Relationship between Federal Reserve Share and Correspondent Concentration in Different Regulatory Regimes, for States with and without Many Small Banks (Standard Errors in Parenthesis)

|                                                                                      | States without many small banks |                                         | States with many small banks |                                         |
|--------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------|------------------------------|-----------------------------------------|
|                                                                                      | Linear specification<br>(1)     | Specification with interaction term (2) | Linear specification<br>(3)  | Specification with interaction term (4) |
| Ratio of reserve requirement amount to total deposits                                | 5.22**<br>(1.42)                | 4.68*<br>(1.46)                         | 3.99**<br>(1.15)             | 3.97**<br>(1.14)                        |
| State level personal income growth                                                   | -0.33<br>(0.33)                 | -0.35<br>(0.33)                         | 0.097<br>(0.15)              | 0.11<br>(0.14)                          |
| Intrastate branching by M&A indicator                                                | -0.010<br>(2.45)                | -5.79<br>(5.70)                         | -3.74<br>(1.79)              | -4.41<br>(3.60)                         |
| State multibank holding companies indicator                                          | -6.07*<br>(3.21)                | -1.52<br>(9.52)                         | -0.83<br>(1.82)              | 3.07<br>(4.25)                          |
| Unrestricted branching indicator                                                     | 4.37*<br>(2.20)                 | 1.06<br>(4.25)                          | 8.42**<br>(2.02)             | -2.82<br>(3.35)                         |
| Interstate banking indicator                                                         | 1.72<br>(2.81)                  | 8.28*<br>(4.26)                         | 2.69<br>(1.83)               | 7.38**<br>(3.11)                        |
| Correspondent balances Herfindahl index                                              | 0.0009<br>(0.0006)              | -0.0014<br>(0.0035)                     | 0.0014**<br>(0.0005)         | 0.0011<br>(0.0021)                      |
| Correspondent balances Herfindahl index* intrastate branching by M&A indicator       | —                               | 0.0019<br>(0.0018)                      | —                            | 0.0014<br>(0.0012)                      |
| Correspondent balances Herfindahl index* state multibank holding companies indicator | —                               | 0.0017<br>(0.0036)                      | —                            | -0.0018<br>(0.0021)                     |
| Correspondent balances Herfindahl index* unrestricted branching indicator            | —                               | 0.00093<br>(0.0012)                     | —                            | 0.0037**<br>(0.0009)                    |
| Correspondent balances Herfindahl index* interstate banking indicator                | —                               | -0.0018**<br>(0.0009)                   | —                            | -0.0018*<br>(0.0009)                    |
| <i>N</i>                                                                             | 571                             | 571                                     | 556                          | 556                                     |
| <i>R</i> <sup>2</sup>                                                                | 0.1996                          | 0.2078                                  | 0.2951                       | 0.3350                                  |

*Note.* All models have year- and state-fixed effects. All variables are in percentage terms, where applicable. States with many small banks are those with more than the median share of assets held by banks with below-median assets.

\*\* Statistically significant at the 5% level.

\* Significant at the 10% level.

and that it indicates that larger banks do tend to use the Fed for services, the other coefficients are remarkably stable, which tends to support our interpretation of the results.

Table VII provides further support for the basic story of vertical foreclosure. Here, we reestimate the models separately for states with relatively high and low numbers of small banks. We define a state as having a large number of small banks if the market share of its below-median sized banks is above the overall median of this variable across all states. These results show that the effects of concentration in the correspondent market are larger in states with more small banks and that the branching interaction effect is more pronounced in these states.

#### 4. CONCLUSION

Studies and discussions of the deregulation of the U.S. banking industry have focused primarily on the beneficial effects of increased horizontal market competition that deregulation has allowed. In contrast, the effects of deregulation on the vertical structure of correspondent banking have not been widely addressed. Our results suggest that unaffiliated banks in states with concentrated correspondent banking markets tended to shift their respondent balances to the Federal Reserve Banks in response to intrastate branching deregulation. This effect is consistent with the hypothesis that correspondents, allowed by the branching deregulation to integrate into downstream retail markets, have an incentive to engage in vertical foreclosure of their downstream rivals or to misuse information gained while acting simultaneously as a correspondent and as a competitor. The presence of the Federal Reserve Banks allowed the smaller unaffiliated banks to avoid (or at least minimize) the costs of foreclosure by shifting their business to the Federal Reserve Banks.

The results supporting this hypothesis are stronger in states in which small banks make up a larger share of the banking market. Smaller downstream rivals are likely to be most adversely affected by foreclosure and are more likely than large banks initially to be customers of a private correspondent. The results are also largely unaffected by including a measure of bank size in the estimated equations, which eliminates the possibility that our results simply reflect the fact that larger banks utilize the Fed and that as banking consolidated with deregulation, the Fed's share of the market rose.

Unlike branching reform, deregulation of restrictions on the formation of multi-bank holding companies appears to inhibit the exercise of market power. By allowing larger networks of affiliated banks, MBHC deregulation seems to enhance competition at the upstream level. As evidence, we show that concentration in the correspondent market became much less important in explaining the Fed's share after both within-state and cross-state holding company deregulation.

The contrasting effects of branching and holding company deregulation suggest the potential importance of organizational design. For example, consider the consequences of the two kinds of deregulation for a small bank living in a two-bank town. Both allow a large correspondent to enter the town. Branching deregulation allows the upstream correspondent bank to buy one of the two banks, convert it to a branch, and foreclose its new rival by exiting the correspondent market, leaving the rival with nowhere to go but the Fed. In contrast, deregulation at the holding company level would force the entering correspondent bank to continue operating the target bank as an affiliate. Now, the acquirer cannot very well exit the correspondent business without leaving its affiliate underserved. Price increases might be possible, but these price changes would be transparent, not just to the remaining bank but to regulators and antitrust enforcers. Thus, vertical foreclosure may not be viable without the ability to conceal that strategy inside a fully integrated organization.

The results also raise questions regarding the role of the Federal Reserve Banks in the correspondent banking market and about the best sequence for the deregulation of an industry that has a significant upstream supplier market. As we discussed in the Introduction, the competition provided by the Federal Reserve Banks in the correspondent market may have been an important component of the successful deregulation of U.S. banking. In addition, if current trends continue, and correspondent markets become more concentrated, access to Federal Reserve Bank correspondent services might continue to remain valuable to unintegrated retail banks.

Finally, it is notable that intrastate branching deregulation largely preceded interstate banking deregulation. This sequence of deregulation allows the possibility of significant vertical integration of local correspondent markets (intrastate branching deregulation) prior to the entry of competition in correspondent services (interstate banking deregulation). Such a sequence was explicitly avoided in the Telecommunications Act of 1996, in which local exchange carriers were required to allow competition into their market prior to being allowed to vertically integrate and offer long-distance services directly to their customers. An analogous sequence would have required correspondents to allow competition into their market prior to being allowed to integrate downstream. The difference may be related to the relatively more competitive correspondent banking market (in contrast to the monopoly position held by most local telephone exchanges) and to the presence of the Federal Reserve Bank competition on a nationwide level. It may be that the passage of DIDMCA was a key element in the later, largely successful geographic deregulation of U.S. banking. While that was true at the time of deregulation, the results on interstate banking allow for the possibility that as other national correspondents are created and competition to the Federal Reserve Banks increases, the Fed's role as a correspondent may decline in importance.

## APPENDIX

Relationship between Federal Reserve Share and Correspondent Concentration in Different Regulatory Regimes 1975–1983:  
Alternative Specifications of Federal Reserve Share (Standard Errors in Parentheses)

|                                                                                                 | Full sample 1975–1983 |                      |                                      | Trimmed sample 1975–1983 |                       |                                      |
|-------------------------------------------------------------------------------------------------|-----------------------|----------------------|--------------------------------------|--------------------------|-----------------------|--------------------------------------|
|                                                                                                 | Reduced form          | Linear specification | Specification with interaction terms | Reduced form             | Linear specification  | Specification with interaction terms |
| Ratio of reserve requirement amount to total deposits                                           | 6.24**<br>(1.09)      | 6.25**<br>(1.09)     | 5.77**<br>(1.12)                     | 4.80**<br>(1.04)         | 4.80**<br>(1.04)      | 4.30**<br>(1.07)                     |
| State level personal income growth                                                              | –0.04<br>(0.13)       | –0.03<br>(0.13)      | –0.07<br>(0.13)                      | –0.06<br>(0.11)          | –0.06<br>(0.11)       | –0.09<br>(0.11)                      |
| Branching only by merger and acquisition                                                        | 0.58<br>(2.29)        | 0.55<br>(2.29)       | –3.20<br>(4.15)                      | 1.30<br>(1.94)           | 1.30<br>(1.94)        | –2.10<br>(3.52)                      |
| Branching via formation of multibank holding companies                                          | –0.56<br>(2.56)       | –0.57<br>(2.57)      | –4.35<br>(6.35)                      | –1.72<br>(4.26)          | –1.72<br>(4.27)       | –4.87<br>(5.69)                      |
| Unrestricted branching                                                                          | 13.82**<br>(5.02)     | 13.90**<br>(5.04)    | 12.41*<br>(6.72)                     | 14.31**<br>(4.26)        | 14.31**<br>(4.27)     | 12.98**<br>(5.69)                    |
| Interstate banking deregulation dummy                                                           | 0.77<br>(3.05)        | 0.78<br>(3.06)       | 6.49<br>(5.36)                       | 0.28<br>(2.59)           | 0.28<br>(2.59)        | 6.52<br>(2.59)                       |
| Correspondent balances Herfindahl index                                                         | —                     | –0.0002<br>(0.0007)  | –0.003<br>(0.003)                    | —                        | –0.000009<br>(0.0006) | –0.002<br>(0.0023)                   |
| Correspondent balances Herfindahl index* branching only by merger and acquisition               | —                     | —                    | 0.0016<br>(0.0013)                   | —                        | —                     | 0.0014<br>(0.0011)                   |
| Correspondent balances Herfindahl index* branching via formation of multibank holding companies | —                     | —                    | 0.0018<br>(0.0027)                   | —                        | —                     | 0.0015<br>(0.0023)                   |
| Correspondent balances Herfindahl index* unrestricted branching                                 | —                     | —                    | 0.0007<br>(0.0018)                   | —                        | —                     | 0.0006<br>(0.0015)                   |
| Correspondent balances Herfindahl index* interstate banking deregulation dummy                  | —                     | —                    | –0.002<br>(0.0013)                   | —                        | —                     | –0.0021*<br>(0.0012)                 |
| <i>N</i>                                                                                        | 441                   | 441                  | 441                                  | 441                      | 441                   | 441                                  |
| <i>R</i> <sup>2</sup>                                                                           | 0.3720                | 0.3721               | 0.3803                               | 0.3750                   | 0.3750                | 0.3850                               |

*Note.* Variable descriptions: The Fed market share equals balances due from Federal Reserve banks divided by the sum of balances due from Federal Reserve banks and balances due from depository institutions in the United States. The variable balances due from Federal Reserve Banks is available for all banks only until 1983. After 1983, it is only available for banks with assets greater than \$100 million. To create a consistent dataset, banks with assets less than \$100 million (1984 constant dollars) were dropped from the sample. Correspondent balances consist of deposits of commercial banks in the United States, deposits of banks in foreign countries, and deposits of foreign governments and official institutions.

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