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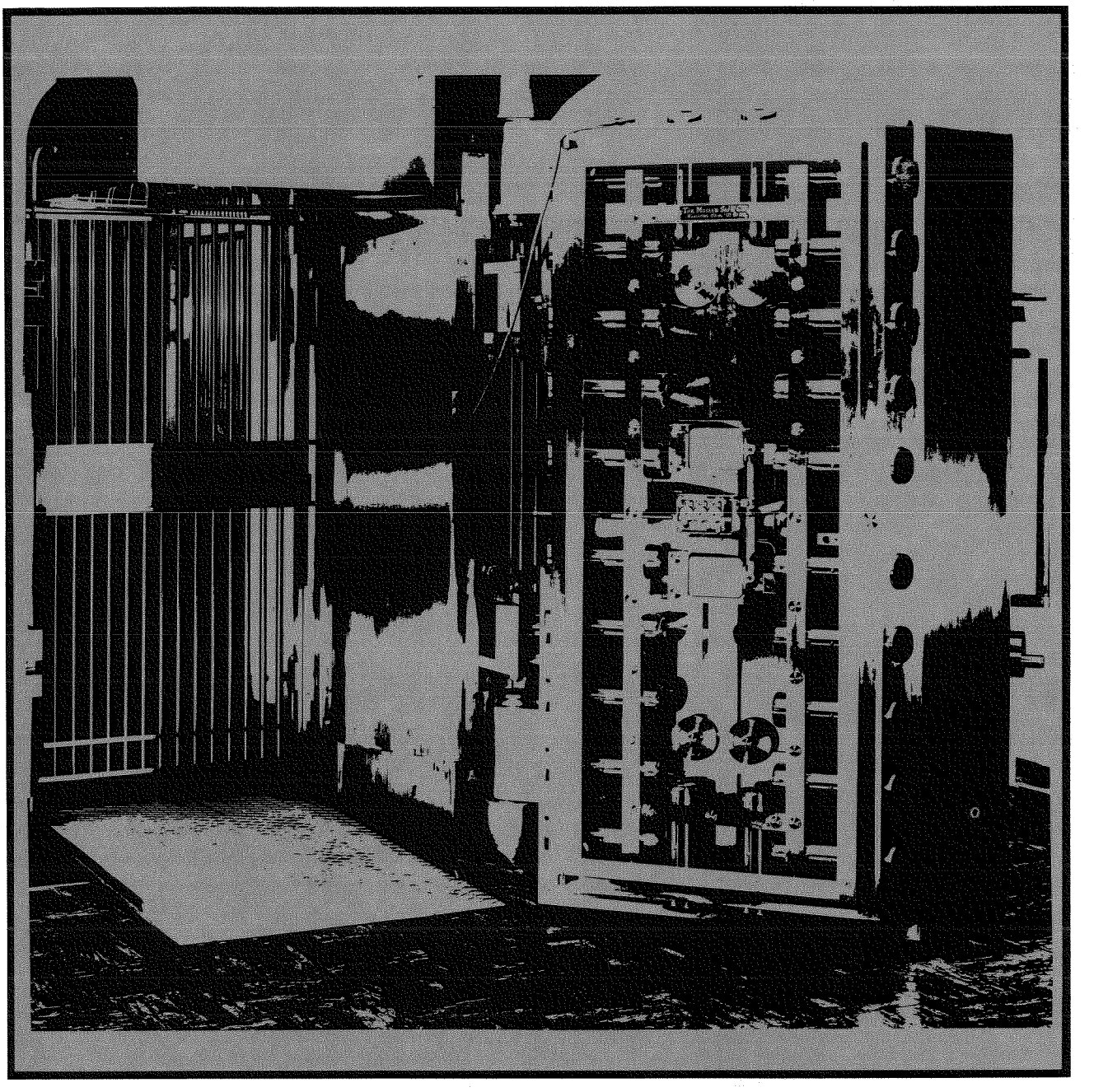

MONEY AND THE MONETARY CONTROL ACT

WINTER 1981

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Money and the Monetary Control Act

Congressman Reuss called it the most significant piece of financial legislation since the 1930's, and Senator Proxmire went even further and called it the most important piece of legislation since the Federal Reserve Act of 1913. But that disagreement aside, few observers would deny that the Depository Institutions Deregulation and Monetary Control Act of 1980 — the MCA — will strongly influence the direction of banking and financial activity in coming decades.

Through the MCA, Congress promoted greater competition in financial markets, primarily by providing for the phase-out of deposit interest-rate ceilings and a broadening of asset and payment powers of banks and thrift institutions. Congress also promoted greater equity and improved monetary control by extending reserve requirements (following a phase-in period) to all depository institutions with transaction (check-type) accounts and nonpersonal time deposits. This step helped to solve the problem of declining Federal Reserve membership, by reducing the cost of reserve requirements for member banks and imposing similar reserve requirements on all insured depository institutions. Moreover, Congress promoted greater efficiency in correspondent-banking markets, by providing access to Federal Reserve services, at explicit prices, for all depository institutions subject to reserve requirements. To highlight the importance of the legislation, this issue of the *Review* considers its implications in two major areas — monetary policy and pricing of Federal Reserve services.

On the monetary control issue, Michael A. Klein analyzes several sweeping changes arising from the MCA — including those sections that don't directly address that specific issue. First, he discusses the role of reserve requirements in facilitating money-stock control when the Federal Reserve uses an aggregate-reserves measure as its control instrument, as it has done for the past year and a half. (In October 1979, the Fed changed its open-market operating procedures to place more emphasis on the control of bank reserves and less emphasis on tightly pegging the cost of bank reserves, the Federal-funds rate.) He presents criteria for evaluating reserve-requirement systems, and develops an argument for uniform required reserves on all accounts included in the monetary aggregate targeted by the authorities, within the context of a simple deposit-multiplier model that includes both member and nonmember banks.

Klein shows that such a regime serves to reduce the number of disturbances that impinge on the money stock, and thereby facilitates monetary control. In other words, the imposition of uniform required reserves reduces the extent of multiplier uncertainty. His analysis also indicates, however, that two provisions of the legislation — a sharply higher reserve requirement on transaction accounts exceeding $25 million than on smaller amounts, and the imposition of required reserves on nonpersonal time deposits — are inconsistent with the logic of a regime of uniform required reserves when the authorities' aim is to control a transactions aggregate.

Klein next examines the effects of the new law on the monetary-control problems caused by the process of financial innovation. Two forms of bank regulation — differential reserve-requirements on alternative deposit accounts, and deposit interest-rate ceilings — have induced a number of innovations in recent decades. Klein's analysis supports other criticisms of interest-rate ceilings, by showing that such ceilings tend to induce shifts of funds among different deposit liabilities in response

to interest-rate fluctuations. But the same analysis shows that deregulation will significantly improve monetary control by reducing the degree of multiplier uncertainty caused by such shifts of funds.

More importantly, deregulation will significantly retard regulation-induced financial innovation, by allowing depository institutions to compete for funds by paying market-determined interest rates. However, the differential between transaction-account and time-account reserve requirements will continue to encourage innovation, although less so than in the past.

Klein argues that the new types of transaction accounts developed in recent years clearly exemplify the innovations generated by regulations. "Such innovations have considerably complicated the task of monetary control by altering the relation between the (old) targeted monetary aggregates and nominal GNP and inflation. Thus in an environment of deregulation, the definitions of the aggregates should be more meaningful economically and, therefore, should be more useful for the conduct of monetary policy."

Turning to the pricing issue, Gary Zimmerman examines the impact of MCA pricing and access provisions on the market for correspondent-banking services. In the pre-MCA environment, Federal Reserve Banks provided correspondent services to member banks free of charge. But nonmember banks, being denied direct access to these services, had to produce them internally or rely on (member) private correspondents.

The passage of the MCA was a major breakthrough in the rationalization of the correspondent-banking system. As Zimmerman argues, it opens the door to equal treatment of all institutions with respect to pricing of (and access to) Federal Reserve services.

Zimmerman argues that, in the pre-MCA environment, free Federal Reserve services represented a major source of inefficiency in the correspondent-banking system. "First, this situation led to overconsumption of Fed services by member banks. Also, by causing the overproduction of publicly produced correspondent services, this pricing policy resulted in an inefficient allocation of resources."

He thus raises the questions: to what extent will MCA provisions enhance competition and improve market efficiency? Also, after the implementation of MCA, will Federal Reserve Banks be able to compete with private banks offering these services? He presents evidence suggesting that Federal Reserve Banks do not have a natural monopoly in providing any correspondent services (except possibly automated clearinghouse services) — and that in many cases, Reserve Banks produce higher-than-optimal levels of such services.

In Zimmerman's view, " 'Full cost' pricing as implemented under the MCA will not eliminate all of the subsidies to institutions using Fed services. However, it will provide Reserve Bank customers with market signals concerning the true cost of the services they consume, providing strong incentives for more efficient use of the services produced."

Zimmerman argues that the post-MCA world will be more competitive and efficient as a result of the partial or complete elimination of Federal Reserve subsidies to depository institutions. He notes that removal of check-processing subsidies will allow private producers to compete on a more equal footing with Reserve Banks. On the other hand, he points out that cash-handling services will continue to be subsidized, but will be available to all depository institutions rather than just member banks.

Zimmerman notes, however, the special nature of automated clearinghouse services. The Federal Reserve's published pricing schedule indicates a short-run willingness to continue subsidies, so that the market grows sufficiently for Reserve Banks to take advantage of their economies of scale in this area. "This would permit lower ACH transfer costs, making them more competitive with check-clearing costs, and thereby helping to reduce the burden on the nation's check-payments system."

Monetary-Control Implications of the Monetary Control Act

Michael A. Klein*

The Depository Institutions Deregulation and Monetary Control Act of 1980 was signed into law by President Carter on March 31, 1980. Referred to by Senator Proxmire as "the most significant banking legislation before the Congress since the passage of the Federal Reserve Act of 1913," the bill (Public Law 96-221) deals with a large and diverse set of monetary-control and financial-regulatory issues. Because of the importance of the monetary-control issue, we concentrate here on that particular aspect of the legislation.

It should be understood that the monetary-control implications of the legislation are not coextensive with its monetary-control *provisions*. Only Title I — designated the Monetary Control Act of 1980 — specifically addresses the question of control, by providing for a system of uniform required reserves (URR) on depository-institution transaction accounts and nonpersonal time deposits. In addition, Title I provides those institutions with access to various Federal Reserve services, and instructs the Fed to develop and implement a schedule of explicit prices for those services.

Title I thus directly addresses the monetary-control issue, but the following two titles also have important implications for that question. Title II provides for the phaseout and ultimate elimination of regulatory ceilings on deposit interest rates, while Title III gives depository institutions permanent authorization to offer certain interest-paying accounts (automatic-transfer accounts, share drafts, and NOW accounts).

These are sweeping changes indeed. The new legislation extends the reach of Federal Reserve requirements from member banks to a number of other institutions, including both nonmember banks and nonbank depository institutions (a term that includes mutual savings banks, credit unions, and savings-and-loan associations). The definition of transaction accounts is similarly broad, encompassing conventional demand deposits, negotiable order of withdrawal (NOW) accounts, savings deposits subject to automatic transfers, and share-draft accounts. More generally, a transaction account is defined as any account on which the account holder may make withdrawals by a transferable instrument for the purpose of making payments to third parties. Moreover, should the process of financial innovation introduce close substitutes for existing transaction accounts, the Federal Reserve Board of Governors has the power under the legislation to classify such accounts as transaction accounts for reserve-requirement purposes.

In Section I, we discuss the role of reserve requirements in facilitating money-stock control when the Federal Reserve uses an aggregate-reserves measure as its control instrument — as it has done since October 6, 1979. At that time, the Fed changed its open-market operating procedures to place more emphasis on the direct control of reserves [Board of Governors, 2]. In this section, we present criteria for evaluating reserve-requirement systems, and develop the fundamental rationale for uniform required reserves (URR), within the context of a simple deposit-multiplier model that includes both member and nonmember banks.

We show that a URR regime serves to

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reduce the number of disturbances that impinge on the money stock and, as a direct result, facilitates monetary control. Put differently, within the framework of a deposit-multiplier model, the imposition of URR reduces the extent of multiplier uncertainty. The analysis also indicates, however, that two provisions of Title I — a sharply higher reserve requirement on transaction accounts exceeding $25 million than on smaller amounts, and the imposition of required reserves on nonpersonal time deposits — are inconsistent with the logic of a URR regime.

In Section II, we examine the effects of the new law on the monetary-control problems caused by the process of financial innovation. Innovations have been directly induced by two forms of bank regulation: reserve-requirement differentials and deposit interest-rate ceilings. Our analysis supports earlier criticisms of the reserve-requirement differential on transaction accounts. That same analysis, however, shows that deregulation will significantly improve monetary control.

First, deregulation will further reduce the degree of multiplier uncertainty by lessening the extent of funds shifts across different deposit liabilities. Second, and more importantly, deregulation will significantly retard regulation-induced financial innovation by allowing depository institutions to compete for funds by paying market-determined interest rates. The new types of transaction accounts dealt with in the Act's Title III clearly exemplify the innovations generated by regulations — primarily limitations on deposit interest rates. Such innovations have considerably complicated the task of monetary control by altering the relation between the (old) targeted aggregates and nominal GNP and inflation. Thus in an environment of deregulation, the definitions of the monetary aggregates should be more meaningful economically and, therefore, should be more useful for the conduct of monetary policy.[1]

I. Title I and Monetary Control: Rationale for Uniform Required Reserves

To gain some perspective regarding the extent of the changes mandated by Title I, we can compare the preexisting reserve-requirement schedule with the provisions of P.L. 96-221 (Table 1). After complete implementation of those provisions,[2] the reserve requirement will be fixed by statute at 3 percent on each institution's transaction accounts of $25 million or less. However, at the end of each year (beginning December 31, 1981), the Federal Reserve will increase or decrease that $25-million figure by 80 percent of the preceding year's (June 30-June 30) percentage change in total transaction accounts of all depository institutions. Although the Act initially sets the reserve requirement at 12 percent for accounts in excess of the base level, the Board of Governors may vary the requirement within the range of 8 to 14 percent. Similarly, the initial requirement of 3 percent on nonpersonal time deposits can be varied, at the Board's discretion, within a range of zero to 9 percent.

Clearly, the new legislation reduces the level of reserve requirements for virtually all member banks, while simplifying the overall structure of reserve requirements (Table 1). At the same time, the new reserve requirements on nonmember banks and other depository institutions partly offset the reduction in required base-money holdings of member banks — as is seen from a Federal Reserve staff study which compares projected base-money reserve holdings under P.L. 96-221 with those that would have been held in the absence of the legislation (Table 2). The estimates cover the 1981-85 period, to reflect the phase-in of reserve requirements stipulated by the law.[3]

The URR concept is, of course, not a new one. For more than three decades, beginning in 1948, the Board of Governors had requested legislation to subject all insured banks to System reserve requirements. The Commission on Money and Credit in the early 1960's,

and the President's Commission on Financial Structure and Regulation in 1971, both supported that same principle. But the acceleration of membership attrition during the 1970's intensified interest in the development of alternative approaches to structural banking reform, and eventually provided the required catalyst for the emergence of the present legislation.[4]

To understand the fundamental rationale for the implementation of a URR regime, we must first develop some general criteria for evaluating reserve-requirement systems. Such a system can have important implications for monetary control when the Federal Reserve attempts to control the money stock with a reserves aggregate instrument. With that instrument set, the joint behavior of the public and the banking system then determines the level of the targeted money stock.

The relationship between the level of reserves and the size of some particular monetary aggregate — the multiplier — is not, however, a constant one. Rather, it is subject to the influence of a wide range of disturbances — disturbances that can originate in any one sector or in all sectors simultaneously. For example, the multiplier may change when the banking system changes its reserve holdings in excess of those required, because this alters the *actual* ratio of reserves to deposit liabilities. Similarly, unpredictable changes may occur in the allocation of the public's asset portfolio between currency and demand deposits, between deposit liabilities of depository institutions with different reserve requirements, and between deposit liabilities and open-market investments. Changes in any of these will alter the ratios on which the multiplier depends. In addition, the setting of the reserves instrument itself will generally require the Federal Reserve to undertake defensive open-market operations, in response to unanticipated changes in such factors as float and Treasury or foreign deposits at the Federal Reserve.

These considerations may be expressed in the following equation:

$$M_i = M_i(\bar{B}, e_1, e_2, \ldots, e_n) \qquad (1)$$

Since the Federal Reserve may target more than one monetary aggregate, M_i simply represents one specific money-stock measure. We assume that the Federal Reserve targets M_i by setting the level of the monetary base[5] — the sum of bank reserves and currency — at $\bar{B}$.

Table 1
Comparison of Reserve Requirement Ratios

A. Applicable Reserve Requirements Under P.L. 96-221

Category	Reserve Requirement	Permissible Range
Net Transaction Accounts		
$0 – 25 million	3%	3% fixed by statute
Over $25 million	12%	8% – 14%
Nonpersonal Time Deposits	3%	0% – 9%

B. Reserve Requirement Ratios in Effect Prior to September 1, 1980

Category	Reserve Requirement
Net Demand Deposits	
$ 0 – 2 million	7%
$ 2 – 10 million	9½%
$ 10 – 100 million	11¾%
$100 – 400 million	12¾%
Over $400 million	16¼%
Savings Deposits	3%
Time Deposits	Varies by maturity and denomination

The remaining terms (the e_j) represent potential disturbances to the system — disturbances that can change the money stock independently of a change in the monetary base.

Within this framework, the reserve-requirement system affects monetary control in two ways. First, that system influences the *number* of potential disturbances that affect the money stock. Second, the setting of reserve requirements affects the *response* of the monetary aggregate to any given disturbance. The system that minimizes the number of disturbances and/or the sensitivity of the money stock to those disturbances is, ceteris paribus, to be preferred from a monetary-control perspective. The rationale for imposing uniform required reserves on all depository institutions is this system's ability to reduce significantly the number of disturbances that can affect the money stock independently of the monetary base.

Theoretical Framework

We can examine the implications of a URR regime by developing a slightly extended version of the standard deposit-multiplier model.[6] The formal model (Exhibit I) describes the behavior of four sectors: the nonbank public (p), the Federal Reserve (f), member banks (m), and nonmember banks (nm). "Nonmember banks" here include all depository institutions whose liabilities are included in the targeted money stock but are not subject to Federal Reserve reserve requirements. The public holds three assets: currency (C), demand deposits and other transaction accounts (D), and time deposits and all other nontransaction-account liabilities (T). A superscript denotes the sector for which a particular financial instrument is an asset; a subscript the sector for which the instrument is a liability. The Federal Reserve is assumed to control the money stock by the use of a base-money instrument($\bar{B}$).

The model assumes that the public holds demand and time deposits with both member and nonmember banks (equations E1 and E3), its holdings with members being a constant fraction of total demand deposits (given by equations E2 and E4). Thus, the variable (k) designates the proportion of publicly held demand deposits at member banks. The public's demands for time deposits and currency, respectively, are constant fractions of their total demand deposits (t and c in E5 and E6).

The required reserves of member banks are determined by the reserve-requirement ratios imposed on demand and time deposits (q_d and q_t) respectively (E7). The demand-deposit liabilities of member banks (equation E8) are held by the public (D_m^p) and by nonmember banks (D_m^{nm}). Member banks are assumed to provide correspondent services to nonmembers which, in turn, hold demand balances with

Table 2
Comparison of Base Money Reserve Holdings
(in millions of dollars)

	1981	1982	1983	1984	1985
Reserves at Fed: Old Structure	27,196	27,078	27,165	27,369	27,742
Member Bank Reserves at Fed: New Structure	21,492	17,964	14,483	12,664	12,724
Other Institutions' Reserves at Fed: New Structure	1,031	1,702	2,315	2,888	3,523
Total Reserves at Fed: New Structure	22,524	19,672	16,749	15,552	16,252
Reserves Released	4,672	7,407	10,366	11,817	11,490

Source: Federal Reserve Memorandum on "Five-Year Cost Projections for Monetary Improvement Legislation."

member banks. The crucial point to note is that member banks' required reserves must be held in the form of Federal Reserve base money only (E7).

In contrast, nonmember banks must satisfy demand-and time-deposit reserve requirements as specified in equation (E9), with these reserves held either as balances with correspondents (D_m^{nm}) or as vault cash (V_f^{nm}). Nonmember reserve holdings are distributed between correspondent balances and Federal Reserve base money (V_f^{nm}) in the proportions $(1 - \alpha)$ and (α) respectively. Thus, base money is divided among currency held by the public, vault cash of nonmembers, and the reserves of members — with its level fixed by the central bank ($\bar{B}$).

The narrow money stock (M-1) is defined as the sum of publicly held currency and demand deposits:[7]

$$M1 \equiv C^p + D_m^p + D_{nm}^p$$

With a given level of the monetary base, we can derive a behavioral specification for M-1 by substituting equations E1-E11 into equation E12, and then setting the total uses of the base so derived equal to $\bar{B}$. The resulting expression for M-1 is

Exhibit I
Deposit Multiplier Model with Nonmember Bank Sector

I. Model Equations

(E1)	$D^p = D_m^p + D_{nm}^p$	Total Public Demand Deposits
(E2)	$D_m^p = kD^p$	Member-Nonmember Demand-Deposit Mix
(E3)	$T^p = T_m^p + T_{nm}^p$	Total Public Time Deposits
(E4)	$T_m^p = kT^p$	Member-Nonmember Time Deposit Mix
(E5)	$T^p = tD^p$	Time-Deposit Demand Function
(E6)	$C_f^p = cD^p$	Public Demand for Currency
(E7)	$RR_f^m = q_d D_m + q_t T_m$	Member-Bank Required Reserves[1]
(E8)	$D_m = D_m^p + D_m^{nm}$	Demand Deposits at Member Banks
(E9)	$RR^{nm} = \lambda_d D_{nm}^p + \lambda_t T_{nm}^p$	Nonmember-Bank Required Reserves
(E10)	$RR^{nm} = D_m^{nm} + V_f^{nm}$	Reserve Eligible Assets for Nonmembers
(E11)	$V_f^{nm} = \alpha RR^{nm}$	Nonmember Demand for Base Money
(E12)	$B = RR_f^m + V_f^{nm} + C_f^p$	Uses of Base Money
(E13)	$B = \bar{B}$	Exogenous Supply of Base Money

II. Coefficient Definitions

k = proportion of deposits held by member banks.
t = ratio of time to demand deposits.
c = ratio of currency to demand deposits.
q_d, q_t = member-bank required-reserve ratios on demand and time deposits.
λ_d, λ_t = nonmember-bank required-reserve ratios on demand and time deposits.
α = proportion of nonmember-bank reserves held as Federal Reserve base money.

1. Member-bank required reserves, RR_f^m, include their vault cash.

$$M1 = \left[\frac{1+c}{r^* + c}\right] \bar{B} \equiv m_1^* \bar{B} \qquad (2)$$

where

$$r^* \equiv \frac{RR_f^m + V^{nm}}{D_m^p + D_{nm}^p} =$$

$$q_d[k + (1-\alpha)(1-k)(\lambda_d + \lambda_t t)]$$
$$+ q_t t k + \alpha(1-k)(\lambda_d + \lambda_t t) \qquad (3)$$

The parameters are defined in Exhibit I.

Equation (2), which expresses the monetary aggregate as the product of the monetary base ($\bar{B}$) and a money multiplier (m_1^*), represents a specific example of the general equation $M_i = M_i(\bar{B}, e_1, e_2, \ldots, e_n)$. The value of the money multiplier can change as a result of shifts in any of the reserve ratios or fractions dividing the public's wealth among alternative assets — and such shifts will affect the money stock if not offset by appropriate changes in the base. Although the Federal Reserve sets member-bank required-reserve ratios (q_d and q_t), it exercises no direct control over the remaining coefficients of the multiplier. We should note in particular the multiplier's dependence on the ratios applying to the nonbank sector. This raises the question of how the presence of nonmember banks might increase uncertainty with respect to the size of the multiplier.

This point can be illustrated by following a random flow of $100 of demand-deposit funds from member to nonmember banks — a shift in (k). Assume that member and nonmember reserve ratios are 20 percent ($q_d = \lambda_d = .2$); assume also that nonmember banks hold all their reserves as correspondent balances (equivalent to $\alpha = 0$). The funds transfer produces no initial change in M-1, since both member and nonmember deposits are included in the definition of M-1. However, base-money reserves are released by this transfer. Member banks release $20 (their loss in deposits multiplied by q_d). Although nonmembers must now hold $20 of additional reserves, these reserves do *not* take the form of base money, but are instead deposited with a correspondent bank (assumed to be a member bank). In turn, the correspondent's base-money reserve requirement increases by $4 (20 percent of $20). Altogether, $16 of base money is released, and if not offset by the Federal Reserve, this leads to an increase in the money stock. Random deposit flows between member and nonmember banks, therefore, can affect the value of the multiplier and exacerbate the problem of monetary control. However, the imposition of a URR regime can significantly reduce multiplier uncertainty, as we shall next see.

Imposition of Uniform Reserve Requirements

Two basic steps are involved in the imposition of a URR regime. First, the assets eligible to satisfy reserve requirements must be identical for all banks. Second, the ratio of bank liabilities held in the form of reserve-eligible assets must be uniform across banks. These changes can be examined with reference to the preceding model.

The most fundamental change is in the definition of the reserve-eligible assets of nonmembers (E10). Under URR, such assets are restricted to the components of Federal Reserve base money (i.e., deposits with the Fed and vault cash).

$$RR^{nm} = D_f^{nm} + V_f^{nm}$$

Correspondingly, the uses of base money (E12) now include nonmember reserve deposits, unlike previously.

$$B = RR_f^m + D_f^{nm} + V_f^{nm} + C_f^p$$

Within the model, this is equivalent to assuming that nonmember reserves held with correspondents are zero ($\alpha = 1$). As can be seen from equation (E11), this means that nonmember-bank reserves must consist of Federal Reserve base money only.[8]

The second step requires that the reserve-requirement ratios imposed on nonmember banks be identical to those on member banks. With the necessary changes, and with the revised uses of the base set equal to $\bar{B}$, the solution for M-1 is

$$M1 = \left[\frac{1+c}{r+c}\right]\bar{B} \equiv m_1\bar{B} \qquad (4)$$

where

$$r = q_d + q_t t. \qquad (5)$$

and, once again, the symbol (r) designates the ratio of base-money reserves to demand deposits.

This structural change has several advantages. The money stock is no longer affected by shifts of funds between member and nonmember banks, by alterations in the composition of nonmember-bank reserve holdings, or by differentials in interstate nonmember-bank reserve requirements. Monetary control is therefore improved, according to our first criterion for evaluating reserve-requirement systems. This improvement, in turn, follows directly from a fundamental principle: the imposition of identical *base*-money reserve requirements on all deposit liabilities included within a given monetary aggregate insulates that aggregate from shifts of funds between those liabilities.

Nonmember-bank demand deposits are included in all monetary-aggregate definitions, and so should be subject to the same reserve requirements as member-bank deposits. Moreover, the newly defined transaction aggregate, M-1B, includes NOW and ATS accounts at banks and thrift institutions as well as credit-union share drafts and mutual-savings banks' demand deposits. Thus, our basic principle applies equally to these institutions under the new URR regime.

If identical reserve requirements on the liabilities included within the targeted money stock are desirable, zero reserve requirements on liabilities excluded from the target are also desirable. This would insulate the targeted money stock from shifts of funds between included and excluded liabilities, as shown in (4) and (5). With a positive reserve requirement against time deposits ($q_t > 0$), the transaction aggregate M-1 is affected by deposit flows between demand and time liabilities (shifts in t). By setting $q_t = 0$, an additional source of disturbance is thereby eliminated.

Evaluation of URR Provisions

The provisions of Title I, however, do not completely conform to the principles stated above. In the first place, the Act subjects all depository institutions to identical, but *not* uniform, reserve requirements on transaction accounts. Specifically, the first $25 million of a bank's deposits is subject to a statutory 3-percent requirement whereas the amount in excess of that is subject initially to a 12-percent requirement, within a possible range of 8 to 14 percent (see Table 1). This increase in the reserve requirement at the $25-million level is almost as large as the previously existing increase in graduated reserve requirements over the entire range of bank size categories. Since, with indexing, the base level changes by only 80 percent of the change in total transaction balances during a given year, an increasing proportion of transaction accounts thus will be subject to higher reserve requirements in the future.

It can, of course, be argued that this provision costs very little in terms of increased multiplier uncertainty. If the distribution of transaction accounts across size classifications is relatively predictable, or if the Federal Reserve can obtain reasonably complete and timely information on that distribution, it can offset induced movements in the money multiplier by appropriate adjustment of its operating instrument. However, the basic rationale of a URR regime is that it simplifies and thus strengthens monetary control. Differentiation between size classes of deposits thus is inconsistent with this objective, and must be defended on other grounds, such as equity for smaller institutions.

Questions also arise about the Act's treatment of time and savings deposits. First, the reserve requirement against savings deposits has been eliminated, which is consistent with improved control over a narrow aggregate such as M-1B. Simultaneously, however, a 3 percent reserve requirement on nonpersonal time deposits has been imposed, with the Federal Reserve given discretion to vary the ratio anywhere between zero and 9 percent. Since time deposits are excluded from the narrow aggre-

gates, this provision is detrimental to monetary control. By contrast, if the target aggregate is broadened to include all time deposits at depository institutions, then the zero reserve requirement on the savings deposits included in that aggregate would be nonoptimal.

Imposing required reserves on nonpersonal time deposits can significantly increase the degree of multiplier uncertainty because such deposits are highly volatile. When the Federal Reserve sets an objective for money-supply growth, it must determine a set of reserve paths that are, in its judgment, consistent with the achievement of the money-growth objective. An important element of this process is predicting the growth rate of *nontargeted* liabilities that are subject to reserve requirements. If these grow faster than expected, a given reserves path will support a slower than anticipated growth rate in the target aggregate.

The last quarter of 1979 provides an example of this type of problem.[9] At its October 6 meeting, the Federal Open Market Committee agreed to a 4.5-percent annual growth-rate target for M-1 and a 7.5-percent growth-rate target for M-2. Total reserves actually grew during that quarter at a 13.8-percent annual rate, and the resulting growth rates in M-1 and M-2 were 3.1 percent and 6.8 percent, respectively — both substantially below their targeted growth rates.[10] Of the 13.8 percent growth in total reserves, less than half (5.6 percent) was absorbed by growth in the targeted aggregates. The remaining factors causing reserve absorption included large negotiable CD's (3.6 percent), interbank demand deposits (2.7 percent), and excess reserves (2.0 percent). The setting of reserve requirements on nontargeted liabilities thus accounted for roughly half of the growth in reserves during this period, creating unnecessary complications for monetary policy. In other words, the Federal Reserve had to predict and then attempt to compensate for disturbances that affected the monetary aggregate only because reserve requirements had been imposed on nontargeted liabilities.[11]

Perhaps more importantly, the variation in reserve requirements among different types of deposits will inevitably stimulate depository institutions to engage in a process of financial innovation, in order to substitute low-reserve-requirement time liabilities for high-reserve-requirement transaction accounts. (This process is examined further in Section II). Such financial innovations can complicate the monetary-control task by altering the relation between targeted aggregates and the authorities' ultimate objective of non-inflationary growth. Admittedly, the URR provisions have reduced the incentive for such innovations, by lowering average and marginal reserve requirements against transaction balances — but substantial incentives still remain.

This problem illustrates the difficulty of setting reserve requirements to promote monetary control. Because the rationale of URR requires zero reserves against non-targeted liabilities, the reserve ratio required for targeted liabilities must be fairly low to discourage financial innovation. However, a low reserve ratio — which is tantamount to a high multiplier — implies a much larger impact upon the money stock of any remaining disturbances. Thus a trade-off exists between the need to reduce incentives for financial innovation and the concern to reduce the money stock's response to disturbances.

To summarize, from a monetary-control perspective, a strong *a priori* case can be made for imposing a URR regime. Such a system reduces the number of random variables that affect any definition of the money stock. In particular, shifts of funds across depository-institution liabilities included in the target aggregate no longer affect monetary control. However, the benefits of URR may be reduced if reserve requirements are based on bank-size classifications, and/or if base-money reserve requirements are imposed on liabilities that are not part of the targeted money stock.[12] Furthermore, the variation in levels of reserve requirements among different deposit categories continues to encourage financial innovations that may further complicate the monetary authorities' task.

II. Regulation-Induced Financial Innovation

Only Title I of the Monetary Control Act specifically addresses the question of monetary control, but Title II and Title III may have even more far-reaching implications in that regard. Title II — The Depository Institutions Deregulation Act of 1980 — establishes a Deregulation Committee to provide for the orderly phaseout and ultimate elimination of deposit interest-rate ceilings. The ultimate goal is the payment of market — rather than regulatory — rates of interest on deposit accounts. The Committee has wide latitude for determining the speed of deregulation, but it must move to full implementation within six years from the Act's passage. Title III — the Consumer Checking Account Equity Act of 1980 — gives permanent authority to different depository institutions to provide certain financial services — specifically, interest-paying transaction accounts such as automatic-transfer-from-savings (ATS) accounts, credit-union share drafts, and negotiable-order-of-withdrawal (NOW) accounts.

These sections of the Act jointly reflect a radically transformed financial environment — a transformation brought about primarily by the impact of high and rising inflation rates on market rates of interest, and by the increasing divergence of market rates from regulation-controlled deposit rates. Financial innovation has been dramatically exemplified by the development of new transaction accounts, such as share drafts and NOW accounts. In turn, financial innovation has had important implications for monetary control. It affects the central bank's ability to control any given aggregate and, more profoundly, it significantly affects the appropriateness of existing definitions of the monetary aggregates. For example, the old distinction between M-1 and M-2 rested on the notion that passbook and time accounts could not serve as a medium of exchange, but that distinction has been rendered meaningless by the development of NOW and ATS accounts. The recent redefinition of the monetary aggregates represents an attempt by the Federal Reserve [13] to develop new aggregates more nearly consistent with the innovation-caused transformation of the financial environment.

In this section, we examine innovation in response to two forms of bank regulation: reserve requirements and deposit interest-rate ceilings. First we modify the previous model to incorporate innovation in response to reserve-requirement changes. Following this, we examine the impact of deposit-rate regulation — and, by implication, of *deregulation* as well. This consideration of behavioral responses to financial regulation significantly broadens the implications of the preceding analysis.

Reserve-Requirement-Induced Innovation

The analysis of reserve-requirement-induced financial innovation begins with an examination of the behavior of the individual banking firm. Assume that the bank issues two types of deposits — demand and time deposits — through the payment of explicit rates of interest, r_d and r_t, with no regulations governing those interest rates. Let

$$D = D(r_d, r_t, r_g) \tag{6}$$

$$T = T(r_d, r_t, r_g) \tag{7}$$

represent the functions determining the amount of demand and time deposits the public will hold. In (6) and (7), the symbol (r_g) is used to represent the open-market rate of interest. It provides a measure of the opportunity cost of holding the liabilities of depository institutions. It is assumed that

$$D_1 \equiv \delta D/\delta r_d > 0,$$
$$D_2 \equiv \delta D/\delta r_t < 0,$$
$$D_3 \equiv \delta D/\delta r_g < 0$$

$$T_1 \equiv \delta T/\delta r_d < 0,$$
$$T_2 \equiv \delta T/\delta r_t > 0,$$
$$T_3 \equiv \delta T/\delta r_g < 0$$

These conditions simply assert that an increase in the demand-deposit interest rate raises the

desired level of demand deposits held by the public, whereas increases in the rates of interest on time deposits and/or open-market assets reduce desired demand-deposit holdings. We may make corresponding assumptions with respect to the time-deposit function.

The initial reserve requirements on demand and time deposits are q_d and zero, respectively. This means that, of each additional dollar of demand deposits, the bank can invest the fraction $(1 - q_d)$. For simplicity, assume that, after satisfying reserve requirements, the bank acquires a single earning asset — one that pays a constant marginal and average rate of return, r_g. The profit function for the individual bank then is:

$$\Pi = r_g(1 - q_d)D + r_gT - r_tT - r_dD \qquad (8)$$

The bank must choose the deposit interest rates, r_d and r_t, which will maximize its profits. The profit-maximization conditions are:

$$\frac{\delta\Pi}{\delta r_d} = r_g(1 - q_d)D_1 + r_gT_1 - r_tT_1 - r_dD_1 - D = 0 \qquad (9)$$

$$\frac{\delta\Pi}{\delta r_t} = r_g(1 - q_d)D_2 + r_gT_2 - r_tT_2 - r_dD_2 - T = 0 \qquad (10)$$

Equations (9) and (10) implicitly determine the bank's offering rates, r_d and r_t, on its deposit liabilities. These rates are chosen so that the marginal revenue the bank receives from lending the funds acquired from each deposit category just equals the marginal costs of such deposits. Reserve requirements affect the marginal revenue from deposits — shown by the presence of q_d in (9) and (10) — and thus influence the bank's offering rates on deposits, as seen in the following example.

We can measure the direct impact of a rise in demand-deposit reserve requirements by differentiating (9) and (10) totally with respect to q_d. Such a rise in reserve requirements produces a fall in the demand-deposit interest rate and, therefore, causes a shift in the public's desired deposit mix in favor of time deposits.[13] In terms of our deposit-multiplier model, a rise in q_d leads to an increase in the value of the coefficient (t), in the following fashion. The increase in reserve requirements reduces the marginal revenue from demand deposits. Profit maximization requires the bank to respond by lowering its offering rate on those deposits. At its new profit-maximizing position, the bank suffers a loss of both total deposit funds and profits.

If this were the end of the story, such considerations could easily be integrated into the preceding deposit-multiplier model. Through a process of financial innovation, however, the bank may succeed in offsetting at least part of its profits loss. For example, the bank could permit its time-deposit account holders to use their balances to cover overdrafts in their checking accounts. Although this may induce switching of funds from lower-rate demand accounts to higher-rate time accounts, the innovation should be beneficial to both the bank and its depositors. The bank could recoup some or all of its lost funds and, simultaneously, switch those funds from higher-reserve-requirement liabilities to lower-reserve-requirement liabilities. The bank's depositors meanwhile could obtain higher yields on their deposits, reflecting the lower reserve requirement on time deposits.

Would monetary control be improved by an increase in reserve requirements on demand deposits? The answer is yes, according to the conventional analysis [Cacy, 3; Kaminow, 6], which ignores the existence of financial innovation. Given a narrow target aggregate, a rise in q_d reduces the size of the money multiplier and, therefore, moderates the impact of exogenous shocks on the money supply. But that conclusion, although technically correct, is also very misleading. Given the financial innovation described here, some transaction balances would now be labeled time deposits, with zero reserve requirements. If transaction balances are the economically relevant object of policy, monetary control could actually be eroded, because of the reduction in the average and marginal reserve requirement on

the transaction aggregate. The effective average reserve requirement on transaction balances would equal a weighted average of the q_d requirement on demand deposits and the zero requirement on the transaction component of time deposits. If reserve-requirement-induced substitution is sufficiently large, this weighted aggregate could be reduced — resulting in a higher money multiplier and *increased* sensitivity of the money stock to exogenous shocks. Professors Stuart Greenbaum and George Kanatas [4] have advanced an argument of this type, despite a substantial difference in approach from ours.

We do not contend that reserve-requirement increases invariably affect monetary control in ways opposite to those normally expected. Rather, we argue only that financial innovation is a predictable response to such increases — and that any analysis of the impact of reserve-requirement changes would be suspect if it failed to consider such induced innovation.

This discussion further illustrates the difficulties created by the variation between the 12-percent reserve requirement on transaction balances and the zero reserve requirement against time-and-savings deposits mandated by URR principles. As argued above, this sharp difference provides a strong incentive for financial innovation, stimulating institutions to develop new accounts which serve the same economic function as traditional transaction accounts, but which can be classified either as time deposits or other liabilities subject to lower (or zero) reserve requirements. Such innovations can substantially complicate the task of the monetary authorities in reducing and controlling inflation, as recent experience indicates.

Incentives for financial innovation could be significantly reduced by narrowing the spread between reserve requirements on different deposit categories. As suggested above, a reduction in the requirement against deposits *officially* classified as transaction accounts might not lower the effective reserve requirement nearly as much against *all* deposits serving the function of such balances, because the incentive to disguise lower reserve-requirement balances would also be reduced. Admittedly, the Federal Reserve can determine what is, and what is not, a transaction account for reserve purposes — and hence, in principle, can compensate *eventually* for the impact of reserve-requirement-induced financial innovations by altering its regulations. Clearly, however, such innovations can present substantial problems in the near- and medium-term future. Hence a regulatory environment that minimizes artificial incentives for innovation is inherently superior, all other factors the same, to one that relies on ex-post regulatory proceedings.

Rate-Regulation-Induced Innovation

Traditionally, the monetary authorities have imposed the highest reserve requirements on demand deposits. Simultaneously, however, Congress has prohibited the payment of interest on such accounts. Consequently, the normal interest-rate differentials that would have been produced by the demand-deposit reserve requirement have been exacerbated by the imposition of interest-rate controls. Against this background, we should examine the deregulation provisions of Title II.

Interest-rate controls on the liabilities of depository institutions are a conspicuous feature of the U.S. financial system. The Banking Act of 1933 prohibited the payment of interest on demand deposits and empowered the Federal Reserve Board of Governors to impose ceiling rates on member-bank time-and-savings deposits. Two years later, the Banking Act of 1935 provided the Federal Deposit Insurance Corporation (FDIC) with similar powers with respect to state nonmember banks. Congress later (1966) extended this network of interest-rate regulations with the passage of the Interest Rate Adjustment Act. Under its provisions, mutual savings banks became subject to FDIC rate regulation, while savings-and-loan associations became subject to rate ceilings administered by the Federal Home Loan Bank Board.

Economists have vigorously criticized these regulations on the grounds that they have led to repeated and disruptive periods of financial

disintermediation [Treasury Dept., 15]; to a substitution of implicit for explicit interest payments [Klein, 8]; and to consistent discrimination against the small saver [Kane, 7]. We confine our analysis to an examination of the monetary control implications of such regulations — and of the benefits flowing from deregulation.

During periods of rising inflation rates, nominal interest rates increase to reflect the anticipated depreciation in the purchasing power of money over the period during which the money is loaned out. This increase in the nominal yield of earning assets acquired by depository institutions would, in the absence of rate regulation, lead them to offer higher yields to their depositors. This can be seen by differentiating (9) and (10) again, this time with respect to r_g. As would be expected,[14] a rise in the rate of return available on bank earning assets leads to an increase in the rates of interest offered on time and demand deposits.

This sympathetic movement of deposit rates in response to changing market rates assures a degree of stability in the public's demand for depository-institution liabilities. Because deposit rates are flexible, there is less need for quantity adjustment. In this case, the effect of the rise in open-market rates on the demand for deposit liabilities is cushioned by the sympathetic movement in deposit interest rates. In contrast, if deposit rates are fixed so that $dr_d = dr_t = 0$, the flow of funds to depository institutions varies substantially. This is, of course, the well-known phenomenon of disintermediation.

We are concerned here with the implications of this phenomenon for control of a given money aggregate. We can see this most easily by assuming that r_d is completely inflexible, whereas r_t is at least partly free to respond to open-market rates of interest. Despite the legal constraints on time-deposit interest rates, regulators frequently have modified such constraints in response to changed open-market rates. Under these conditions, an increase in the open-market rate will induce a substitution between bank liabilities and open-market investments — and in addition, the changed structure of bank deposit rates will cause depositors to shift funds between various liability categories. In the preceding section, we treated shifts in the coefficient (t) as purely random, whereas such shifts in fact have a strong systematic component. Changes in relative interest rates on deposits — and changes between deposit rates and open-market rates — induce changes in the behavioral coefficients of the deposit-multiplier model. Rate regulation inevitably magnifies the size of those changes and is, therefore, inconsistent with effective monetary control.

The problems that rate regulation poses for monetary control are significantly compounded by financial innovation in response to those regulations. Innovation here takes two forms. First, in a manner analogous to the case of an increased reserve requirement on demand deposits, banks and their depositors both have a strong incentive to evade the regulations — at least in part, through a form of innovation that enables what are, essentially, transaction balances to be transferred to liability classifications that are less constrained by the rate restrictions. Since those liability types generally have different reserve requirements than demand deposits, monetary control is inevitably weakened.

Perhaps more importantly, institutions that are not subject to deposit rate ceilings could respond by offering liabilities similar to those of the constrained institutions — offering an interest rate on their liabilities which is, at least, closer to the market rate than the offering rates of the constrained institutions. In the mid-70's, for example, thrift institutions developed NOW accounts and share drafts, and in more recent years, the mutual-funds industry developed the fast-growing money-market funds. Given the sharp difference in reserve requirements between rate-constrained institutions and those unconstrained institutions, monetary control once again is significantly weakened.

The process of financial innovation is, of course, an ongoing one. It is neither necessary nor desirable for innovation to be suppressed,

or deplored for its effects on monetary-control procedures. It is, however, desirable — and it may be necessary — that policymakers formulate control procedures so that the procedures themselves do not induce further financial innovation.

In this respect, Titles II and III together should unambiguously improve monetary control. First, the legislation provides for gradual relaxation of interest-rate constraints on time deposits, and thereby reduces the variability of the differential between open-market and time-deposit rates of interest. Second, the legislation provides permanent authorization for demand-deposit substitutes (such as NOW accounts) and for rate deregulation on such accounts — even though it does not expressly repeal the 1933 prohibition of interest on demand deposits. The legislation thus reduces the variability of the rate differential between at least some components of the transaction aggregate, M-1B, and time deposits. Congress thus has reduced the likelihood of "nontraditional" institutions developing successful transaction-account substitutes, through its decision to permit banks and other depository institutions to compete for funds by offering explicit, competitively determined interest rates. As a consequence, the monetary aggregates should retain a more consistent economic interpretation, and therefore, should be more meaningful for the conduct of monetary policy.

III. Summary and Conclusions

The Depository Institutions Deregulation and Monetary Control Act of 1980 should have profound implications for the nation's financial structure, for competition among banking institutions — and above all, for monetary control. The reserve-requirement and deregulation provisions examined in this paper are only two of the elements affecting the Federal Reserve's ability to control the monetary aggregates and, through this control, to reduce inflation and promote stable economic growth. Indeed, monetary control is a complex process about which significant disagreements still exist. But on the whole, the Act is likely to aid the Federal Reserve in its task of monetary control, despite the impediments created by several provisions of the Act.

Certainly, the benefits of deregulation are unambiguous. Deregulation will improve equity by allowing all savers equal access to investment opportunities, will promote efficiency by removing artificial barriers to competition — and will enhance monetary control by reducing most of the incentives for financial innovations that alter the economic significance of targeted monetary aggregates. All these considerations strongly support the wisdom of Title II of the legislation.

The reserve-requirement provisions are more problematical. Theoretically, monetary control is best promoted when reserve requirements are imposed on targeted liabilities, but *not* on untargeted liabilities. Thus the appropriate setting of reserve requirements depends upon the precise definition of the aggregate to be targeted. Despite the lack of consensus on this point, at least a preliminary case can be made for targeting a broad transaction aggregate, such as M-1B. This aggregate can at least be given a consistent interpretation in terms of a medium-of-exchange concept of money [Berkman, 1].

Generally, but with some important exceptions, the reserve-requirement provisions are consistent with the objective of controlling a broad transaction aggregate. In contrast to the previous situation, most transaction balances (but not untargeted liabilities) will be subject to uniform reserve requirements. The law also gives the Federal Reserve considerable flexibility in adapting to the changing financial environment by providing it with the authority to establish uniform reserve requirements on all accounts which serve the function of transaction balances.

In other respects, however, the Act's provisions do not go far enough in the direction

needed for optimal monetary control. First, the differential between the reserve requirement on the first $25 million of transaction balances and the requirement on larger balances clearly violates the basic principle of uniform reserve requirements. Even though the fraction of deposits subject to the lower requirement is likely to decline over time (because of the partial indexing of the cutoff), the basic logic and intent of the Act argue for the abolition of this differential.

More importantly, the Act continues to impose reserve requirements on nonpersonal time deposits, which is inconsistent with the URR principle under any plausible choice of targeted aggregates. Given the objective of controlling M-1B, shifts between transaction and nonpersonal time accounts will continue to lead to unwanted changes in the multiplier. But optimal control of a broader aggregate (including time and savings accounts) requires equal ratios for transaction and nonpersonal time balances. In either case, the present reserve requirements against nonpersonal time deposits should be changed to reflect the URR principle. Given the M-1B control objective, this can be accomplished at the Federal Reserve's discretion simply by reducing reserve requirements on nonpersonal time deposits to zero.

Finally, the process of financial innovation strongly affects the use of reserve requirements for promoting monetary control. In the absence of such innovations, monetary control considerations *alone* might argue for a fairly high reserve ratio (low multiplier), because this approach would provide the best means of insulating the targeted aggregate from any remaining disturbances to the base. In an environment favorable to financial innovations, however, even moderate reserve requirements against transaction balances can create problems. The higher the reserve ratio — assuming URR requirements are met — the greater the incentive of financial institutions to modify non-reservable accounts so that they can be used for transaction purposes. Such a process considerably complicates the authorties' money-control task, since it forces them to adjust their targets for the officially defined aggregates continually to reflect the innovations. Such adjustments are necessarily imprecise and uncertain in the short run. On this basis, the present 12-percent reserve requirement against transaction balances may be too high for purposes of monetary control. Our argument suggests that the ratio should be lowered to the present statutory minimum of 8 percent — and perhaps even this lower limit should be reconsidered as well.

FOOTNOTES

1. Michael Keran has suggested the term "measurement uncertainty" to describe the control problems caused by regulation-induced financial innovation. Thus, Section I of this article deals with the implications of P.L. 96-221 for multiplier uncertainty, whereas Section II examines its implications for measurement uncertainty.

2. The new law stipulates a gradual phase-in of reserve-requirement provisions. On September 4, 1980, reserve requirements of Federal Reserve member banks were reduced by 25 percent of the difference in the required reserves under the new and old systems. Subsequent phasedowns will occur annually until September 1, 1983. Reserve requirements for other institutions are being phased in over an eight-year period, with complete implementation scheduled for September 3, 1987. We have limited our analysis to the case of full implementation.

The Act also provides for the imposition of a supplemental (interest bearing) reserve requirement of up to 4 percent on transaction accounts. This requirement could be imposed only if existing reserves were deemed inadequate for monetary-control purposes. The term "inadequate" is not defined in the legislation.

3. The member-bank estimates provided in this table are adjusted for the estimated attrition of member banks in the absence of legislation designed to halt the exodus.

4. A brief history of URR proposals is provided in Robert Knight [9].

5. Alternative specifications of central-bank behavior are clearly possible. The Federal Reserve could, for example, set the level of bank reserves — either total reserves or nonborrowed reserves — rather than the monetary base. A general treatment of these alternatives is provided by Kaminow [6] and Cacy [3].

6. The model is similar to that of Kenneth J. Kopecky [10]. Kopecky's analysis, however, ignores liabilities other than demand deposits. Note that for the purposes of the present model, "non-member banks" include institutions (such as credit unions) that issue transaction balances but which are not normally denoted as banks.

7. We use the old definitions of the monetary aggregates to illustrate the reserve-requirement principles. During the 1970's, the Board of Governors undertook a major research effort on the process of financial innovation, focusing on the appropriate definitions of the monetary aggregates in a changed financial environment. The original Board proposal is given in Simpson [13]. A critical review of the new aggregates is provided by Berkman [1]. An example of the research methodology is given in Porter, Simpson, and Mauskopf [12]. Subsequent sections of the present article discuss the relevance of P.L. 96-221 to the newly defined transactions aggregate M-1B.

8. Setting $\alpha = 1$ provides an additional simplification of the model. From (E10) and (E11), $\alpha = 1$ implies that $D_m^{nm} = 0$; interbank deposits are eliminated. This specification implies (incorrectly) the demise of the correspondent-banking system — the imposition of URR will affect the correspondent network, but not dramatically. Estimates are provided in Horvitz [5].

9. The following data are taken from the Congressional testimony of Federal Reserve Chairman Volcker [16].

10. The testimony indicates that the actual growth rates, although slower than targeted, were not below what the FOMC found "acceptable". See [16, p. 16].

11. In a 1972 study of money-supply control, Poole and Lieberman [11] examined the sources of variability in the ratio of total member-bank required reserves to member-bank demand deposits, using weekly data over a 53-week period. The three largest sources of variability were due to time deposits, Treasury deposits, and interbank deposits, in order of importance.

12. Variability in the coefficient (t) could have been responsible for the results of the influential study of the impact of nonmember banks conducted by Dennis Starleaf [14]. For the period 1962-73, he found less variability in the ratio of aggregate reserves to demand deposits than in the ratio of member-bank reserves to deposits. He concluded that nonmember banks were not a monetary-control problem.

The beneficial impact of nonmember banks may have been due to the fact that Federal Reserve reserve requirements set $q_t > 0$ during the period of study. Since the *base-money* reserve requirements against time deposits were smaller for nonmembers than for members, the presence of nonmembers could have insulated the narrow money stock from variability in (t).

13. Denote by H the matrix of second-order partial derivatives of the profit function. By the second-order condition, the determinant of H (det H) must be positive. Differentiating (9) and (10) with respect to q_d and assuming that D and T are linear in their respective arguments, we derive

$$dr_d/dq_d = [(T_1 + D_2)D_2r_g - 2T_2D_1r_g]/\det H$$

and

$$dr_t/dq_d = [(D_2 + T_1)D_1r_g - 2D_1D_2r_g]/\det H$$

To simplify the analysis, assume the cross-rate effects are approximately zero. That is, $D_2 = T_1 = 0$. Thus

$$dr_d/dq_d < 0$$

$$dr_t/dq_d = 0$$

14. If we assume, once again, that $T_1 = D_2 = 0$,

$$dr_d/dr_g = 2T_2[(1 - q_d)D_1 - D_3]/\det H > 0$$

and

$$dr_t/dr_g = 2D_1[T_2 - T_3]/\det H > 0$$

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The Pricing of Federal Reserve Services under MCA

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The pricing and access provisions of the Depository Institutions Deregulation and Monetary Control Act of 1980 (MCA) require Federal Reserve Banks to begin imposing explicit charges for the correspondent-banking services they offer. The Act also provides for access by all depository institutions to major Fed services: check clearing and collection, automated clearinghouse transfers, wire transfers, coin and currency, settlement, and securities safekeeping. Previously, these services had been restricted largely to member banks. Implementation of the Act's pricing and access provisions during the 1981-82 period thus will bring about a major restructuring of correspondent-banking markets. Still, after implementation, Federal Reserve Banks will probably maintain their position as primary suppliers of major correspondent-banking services.

The MCA's pricing and access provisions are aimed at improving the markets for correspondent-banking services in two major ways. First, the Act seeks to promote increased competition by requiring Federal Reserve Banks to charge all users of Fed services an amount equal to their cost. This would change the Fed's former service policy — supplying services free-of-charge to member banks while denying access to non-members — which tended to restrict and distort competition from the private sector. Second, the Act seeks to correct inefficiencies in the production and distribution of correspondent-banking services fostered by the Fed's former policy practice of providing free services to members. This practice often led Reserve Banks to produce at higher marginal costs than their private competitors, which raised the total cost of correspondent services to society and stimulated overconsumption of such services.

This paper examines the impact of MCA pricing and access provisions on the market for correspondent-banking services. It raises the question: to what extent will these provisions enhance competition and improve market efficiency? Also, after the implementation of MCA, will Federal Reserve Banks be able to compete with private banks providing these services?

We begin with a description of the market for correspondent-banking services (Section I). Next we explain MCA's pricing and access provisions (Section II), and analyze how these may improve competition and efficiency in these markets (Section III). However, the final results will depend critically upon the Reserve Banks' ability to produce services comparable to those provided by the private sector, at competitive costs. Estimates of the cost functions facing Reserve Banks (Section IV) suggest that the System will be quite competitive in providing check-clearing services — and that it may dominate the market for automated-clearinghouse transfers because of substantial economies of scale. Taken as a whole, the evidence suggests that the MCA will significantly alter existing patterns of use of correspondent and Reserve Bank services. The potential benefits in terms of increased competition and enhanced efficiency appear to be substantial, despite the continued existence of several features of the pre-MCA environment.

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I. Features of the Correspondent Banking System

The actions of several types of institutions define the correspondent-banking system's role in the nation's payments mechanism and financial structure. The nation's central bank, the Federal Reserve, plays a prominent role as a supplier of certain correspondent-banking services, such as check-clearing and coin-and-currency services. Many large member banks, called correspondent banks, supply these and other banking services to smaller banks, called respondents — in addition to providing for their own operations. In some situations correspondents provide these services internally, while in others they rely on other correspondents or on Federal Reserve Banks for services. Smaller banks have often contracted services out, because of the greater cost of providing services internally, in relation to using "free" Federal Reserve services or purchasing services from correspondent banks.

Both private correspondent banks and the Federal Reserve System have long supplied certain correspondent-banking services — funds transfers, check clearing and settlement, and provision of coin and currency. In some cases the services are complementary, as in automated clearinghouse (ACH) operations, where correspondent banks handle the preparation of tapes necessary for the electronic transfers, while the transfers themselves are usually cleared and settled through the network of ACH facilities operated by the Federal Reserve. In most cases, however, the services offered by both the private sector and the Reserve Banks are close substitutes.

In the pre-MCA environment, Federal Reserve Banks provided correspondent services to member banks free of charge. But non-member banks, being denied direct access to these services, had to produce them internally or rely on (member) private correspondents.[1] This policy was designed to induce member banks to remain in the system. In effect, the free provision of services partially compensated member banks for the burden on their earnings represented by the requirement that their reserves be held as vault cash or as non-interest-bearing deposits with Federal Reserve Banks.

Yet despite the availability of subsidized Fed services, many member banks (particularly smaller ones) relied heavily on the more costly services provided by private correspondents. Several factors affected each bank's decision to use public or private correspondent services, including:

1. Relative prices charged by various public and private suppliers;
2. Perceived differences in the quality of comparable services, such as faster service, earlier availability of funds, later deadlines, etc.;
3. Relative costs incurred by respondents. For example, costs associated with encoding or sorting checks to meet Reserve Bank specifications and/or higher reserve-balance adjustment costs related to use of Reserve Bank services may be more expensive than sorting or reserve-adjustment costs associated with using correspondent services.

These three factors will continue to influence bank decisions under the MCA, but the Act itself will influence the choices made, primarily by altering relative price relations. Prior to the implementation of MCA, many small member banks purchased services from correspondents despite the availability of free Federal Reserve services, because the benefits of free services failed to offset quality and/or preparation-cost differentials. In fact, several studies suggest that the Federal Reserve was relatively unsuccessful in competing for the business of small banks; for example, from one-half to one-third of small member banks relied on correspondents for all their check-clearing services.[2] The ability of private correspondents to offer tailored services, designed to meet the needs of selected customers, may account for some of their success, as it provided them with a niche in the market not covered by "standard" Federal Reserve services.

Services Available

Comparisons of Reserve Bank services with those provided by correspondents should help determine the direction of post-MCA markets. In a broad sense, most private services are comparable to services supplied by Reserve Banks, yet differences exist among correspondent services, and also between correspondent and Reserve Bank services. These differences reflect variations in marketing procedures, service standards, and pricing practices. Price comparisons can be inexact because of the existence of different pricing practices among correspondents — and because of the widespread correspondent practice of reselling Federal Reserve services. This practice may dramatically alter correspondent fee structures once Reserve Banks begin pricing their services.[3]

Check clearing and settlement refer to the entire process for transferring checking and NOW account funds between economic agents. This process is essential for the swift and reliable transfer of funds. It encompasses a number of steps, including the encoding of transaction information on checks, presorting by type and by destination, microfilming for records purposes, transportation, sorting by bank for payment and settlement, and the actual clearing among banks or clearing-house members.

Checks may take several routes in the clearing process, but roughly 45 percent of the total are cleared through the Federal Reserve System's check-processing facilities.[4] Prior to the implementation of the MCA, most (but not all) member banks presented at least some checks at their local Reserve Banks for clearing and settlement. Non-member banks — lacking access to Reserve Bank clearing services — and many small member banks meanwhile relied on the check-processing services provided by correspondent banks. Many of these correspondents also used Reserve Bank facilities to clear both their own and their respondents' checks. Hence, correspondent check-clearing costs can be expected to increase once MCA pricing provisions are implemented.

Automated-clearinghouse (ACH) facilities transfer funds electronically. In this system, a central computer accepts and executes the electronic messages (generally provided from computer tape) that are necessary for a "paperless" transfer of funds. At present the Federal Reserve System provides the only nationwide ACH network, clearing nearly all ACH transfers outside of New York City. The Federal Reserve System has actively promoted ACH's, hoping to increase the efficiency of the payments mechanism by reducing its reliance on the traditional paper check. However, most ACH transfers — over 80 percent of the total — continue to be Government-related payments.[5]

In an initial stage, correspondents generally prepare tapes containing the debit, credit and account information necessary to transfer funds through an ACH. Then Reserve Banks, using the tapes provided by commercial banks, provide further processing and then clear and settle the electronic transfers among local ACH members. Thus, Reserve Bank costs reflect primarily clearing and settlement costs, while correspondent fees cover handling and preparation costs. Because the services are complementary rather than competing, direct per unit fees for correspondents' ACH services are not comparable with Reserve Bank costs.

Another major service involves the provision and receipt of coin and/or currency to and from banks. Here again, Reserve Bank services partly complement, and partly substitute for, those provided by correspondent banks. Both Reserve Banks and correspondents provide central cash vaults for safekeeping, as well as handling, verification, and packaging services. However, the Federal Reserve also provides services, such as the replacement and destruction of coin and currency, that reflect its role as the nation's central bank. Furthermore, as with check services, some correspondents rely on Reserve Banks to fill their coin and currency orders. Hence, the cost of such correspondent services can also be expected to increase once the Federal Reserve begins charging for its own services.

Correspondent banks in the past had trouble

competing with the Federal Reserve, which provided a subsidy to member banks in the form of "free" correspondent services. Segmentation of the market into two groups of banks, some with access and some without access to "free" Reserve Bank services, meant that nonmembers had to rely on correspondents for their correspondent-banking services.

II. New Direction for Correspondent Banking

The pricing and access provisions of the Monetary Control Act established the direction of future development in the markets for correspondent-banking services. The Act required the Federal Reserve to publish a set of pricing principles and a proposed schedule of fees by September 1980. At set times during 1981 and early 1982, the Reserve Banks are beginning to price individual services, using fee schedules based on the pricing principles announced in 1980.

The passage of the MCA was a major breakthrough in the rationalization of the correspondent-banking system. The reserve-requirement changes it mandates should substantially equalize the burden of holding reserves among all depository institutions (see the article by Michael Klein in this *Review*). In addition, it opens the door to equal treatment of all institutions with respect to pricing and access of Federal Reserve services.

The Act requires pricing for a number of correspondent services (including Federal Reserve float) formerly provided for free or at a nominal cost by Reserve Banks. The four major services considered here — check clearing and collection, automated clearinghouse transfers, coin services, and currency services — account for nearly 80 percent of all Federal Reserve System costs of providing correspondent-banking services (Table 1).

In the words of the Monetary Control Act:[6]

> The schedule of fees prescribed pursuant to this section shall be based on the following principles:
>
> (1) All Federal Reserve bank services covered by the fee schedule shall be priced explicitly.
>
> (2) All Federal Reserve bank services covered by the fee schedule shall be available to nonmember depository institutions and such services shall be priced at the same fee schedule applicable to member banks, except that nonmembers shall be subject to any other terms, including a requirement of balances sufficient for clearing purposes, that the Board may determine are applicable to member banks.
>
> (3) Over the long run, fees shall be established on the basis of all direct and indirect costs actually incurred in providing the Federal Reserve services priced, including interest on items credited prior to actual collection, overhead, and an allocation of imputed costs which takes into account the taxes that would have been paid and the return on capital that would have been provided had the services been furnished by a private business firm, except that the pricing principles shall give due regard to competitive factors and the provision of an adequate level of such services nationwide.
>
> (4) Interest on items credited prior to collection shall be charged at the current rate applicable in the market for Federal funds.

Pricing will eliminate the major subsidy the Federal Reserve formerly provided to institutions using its services. Prices are to be set so that all long-run costs incurred by a private competitor will be included in the costs that Reserve Banks must cover. This means that Reserve Bank prices, in principle, shall take into account all:[7]

- —Direct costs
- —Indirect costs
- —Overhead
- —Imputed taxes
- —Imputed return to capital

Covering all of these costs eliminates the major competitive advantage formerly held by Reserve Banks in providing free services to member banks.

Under the MCA, Federal Reserve prices may be set at several levels of operations, the only constraint being that revenues generated

from each service cover the full cost of providing the service. Thus, prices may be set at a national level (such as the proposed prices for ACH transfers), or at a District level (such as prices for check, coin and currency services in certain areas), or at the zone or office level.[8] Variations at the district or office level would allow price schedules to reflect regional differences in costs of providing services. Correspondent banks as well as Reserve Banks may encounter such differences because of regional variations in wages and salaries, as well as transportation expenses.

Federal Reserve guidelines also require Reserve Banks to treat differentiated services within a product line as separate services for pricing purposes. For example, checks will be separated into several categories, depending upon the cost of processing and transporting various types of checks. This treatment is necessary if Reserve Banks hope to be competitive in the check-clearing area. For ACH operations, however, where a standardized national market exists, a single price will suffice for all local ACH transfers.

The MCA was designed, through a restructuring of the system, to improve the competitive position of private banks selling correspondent-banking services. Obviously, in the pre-MCA world these correspondents were at a severe disadvantage when competing for the business of member banks, since the latter already had access to free Federal Reserve services. Pricing Reserve Bank services at "cost" thus will allow a significant increase in competition from correspondents, who will be able to compete on price as well as the quality of services.

Competition also should be encouraged by the provision authorizing access to Reserve Bank services for nonmember banks and other nonbank depository institutions. Competition from Reserve Banks for such customers opens this segment of the market to competition; formerly, this market was served only by correspondents.

Table 1

Federal Reserve Expenditures	1979 Expenditure (in millions)
Check Clearing and Collection Services	$ 245.0
Currency Services, Total†	63.0
Coin Services, Total†	25.9
ACH Services*	12.5
Total for four services examined	346.4
Other Correspondent Services to Financial Institutions and the Public	88.7
Other Expenses	327.7
Total Federal Reserve Expenses (gross)	$ 762.8

*Includes ACH expenditures, and estimated overhead for Electronic Funds Transfers that should be allocated to ACH operations. †Non-governmental expenses.

Source: 1979 PACS Annual Detail Expense Report, and 1979 PACS Summary Expense Report, Board of Governors of the Federal Reserve System, 1980.

III. Pricing and Efficient Allocation of Services

Free Federal Reserve services represented a major source of inefficiency in the correspondent-banking system prior to implementation of the MCA's pricing and access provisions. First, this situation led to overconsumption of Fed services by member banks. Also, by causing the overproduction of publicly produced correspondent services, this pricing policy resulted in an inefficient allocation of resources.

What are the necessary conditions for efficient production and consumption? First, efficient production requires that the cost of the last unit produced (i.e. the *marginal cost* of production) be equal for all suppliers. Otherwise, the total industry output obtained from a given amount of resources could be increased by shifting production from high-cost to low-cost producers. Second, efficient consumption requires that each user of a service pay a price equal to the marginal cost of producing it. If, for example, the price charged were set below the marginal cost, individuals would be led to over-consume the service, in the sense that its worth to them would fall short of its (marginal) cost to society as a whole. Hence, efficient production and consumption requires that all firms incur the same marginal costs *and* that all users pay the same price for a given service. Neither of these conditions held true in the pre-MCA environment.

The Federal Reserve's practice of charging less than marginal cost led to overconsumption of its services. That is, respondent and correspondent banks in the aggregate used far more "free" Federal Reserve services than they would if they had had to pay full cost for them. This represented a waste of resources, because the worth of the services to users was then less than their actual cost to society. Overconsumption resulted from the gap between the Reserve Bank's marginal cost of production (some positive number) and the fee it charged for use of those services (typically zero).

For similar reasons, production inefficiencies also occurred in the pre-MCA era. In this situation, member banks naturally increased their demand for "free" Federal Reserve services while reducing their demand for other privately-supplied services. Reserve Banks therefore produced relatively more services, and correspondents relatively fewer services, than they would if Reserve Banks had based their prices on actual costs. Thus, as suggested below, Reserve banks often produced at higher marginal costs than their private competitors. To the extent this was true, resources could have been saved by reallocating production from Reserve Banks to lower-cost private producers.

Production of correspondent services may also have been misallocated among Reserve Bank facilities. Efficient production of services requires that the difference between marginal costs be no greater than the cost of transportation between competing facilities. Otherwise, the costs of producing and delivering a given service could be reduced by shifting production among facilities. Even with efficient production, local or regional factors could lead to variations in marginal production costs without necessarily implying inefficiency in the production of a particular service. (These regional factors include state branch-banking laws, regional cost-of-living factors, and other geographic considerations.) In the pre-MCA environment, however, Reserve Bank facilities had an incentive to produce up to the quantity demanded at the zero price, but no incentive to equalize marginal costs (less transportation expenses) across facilities. As a result, production at some Reserve Bank facilities probably could have been more efficiently produced at other (or new) facilities. This may indeed have been the case, as we can see from the following discussion of estimated long-run average cost curves for various correspondent services.

MCA implementation will promote efficiency by instituting full-cost pricing, but the Act will not eliminate all of the inefficiencies associated with the present system. Prices under the MCA will be determined by current

average (rather than marginal) costs of production. Pricing at marginal cost would eliminate the gap between the price private institutions pay for services and the production costs incurred by Reserve Bank facilities in producing the last unit of service. Long-run average-cost pricing will significantly reduce the gap between the price correspondents pay and the cost of producing these services. But this approach, unlike marginal-cost pricing, will not completely close the gap unless the services are produced at constant costs — which (as noted below) does not appear to be the case.

Continued inefficiencies also will arise from the proposed pricing procedure for ACH and coin-and-currency services. Reserve Banks will price only coin-and-currency transportation and coin-wrapping services. (They will continue to provide administrative and handling functions for free, however, since these functions may be considered a governmental responsibility, although correspondents also provide these services in many cases.) The Fed proposes to set ACH fees at an estimated long-run average-cost level that is considerably below the present level of costs. As the volume of ACH transfers rises over time, significant economics of scale could lead to a substantial reduction in the cost per ACH transfer. The Federal Reserve thus has set its proposed price to approximate long-run average cost at a mature output level.

Other factors — market size, geographic location of facilities, competitive factors, and economies of scale — may all affect the efficiency of Reserve Bank facilities under the MCA's pricing and access provisions. Scale economies, or diseconomies in particular, may profoundly affect a Reserve Bank's market share. For example, some offices are currently operating either off of the estimated long-run average-cost curve, or at a volume considerably above or below that at which average cost is minimized. In the long-run, MCA pricing creates incentives for those facilities to move toward a more efficient scale of operations. For example, large-volume producers operating in the region of decreasing returns to scale will incur higher average costs, and this will lead to higher prices, making these facilities less competitive vis-a-vis correspondents. Higher relative prices will cause Reserve Banks to lose customers, and this process will tend to return these facilities to a level of output that minimizes minimum average cost.

IV. Estimating Long-Run Average Cost and Average Prices

The future of the correspondent-banking industry largely depends upon the state of competition between private producers and the largest single seller of correspondent services, the Federal Reserve System. The Reserve Banks' ability to compete and their ultimate share of the market will hinge on answers to three related questions. First, do economies of scale allow the high-volume facilities operated by the Federal Reserve System to produce services more efficiently than private competitors? Second, in the pre-MCA environment, how did the average cost of Fed services compare with the fees set by private correspondents? The answer will be critical in determining how Reserve Banks will fare in the short run. Finally, how do the average costs of facilities compare with the estimated minimum average cost? This comparison will provide an indication of the Federal Reserve's ability to compete in the long-run.

Scale Economies

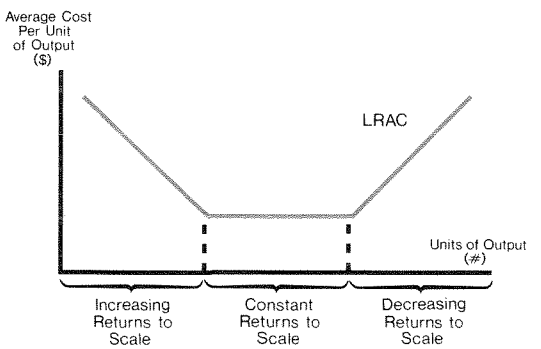
These questions can be analyzed in terms of the long-run average-cost relationship — the relationship between the average cost of production for each Federal Reserve facility and the level of production at that facility. The typical long-run average-cost curve is U-shaped, with each of the curve's three regions exhibiting a different relationship between average cost and output (Figure 1).

In the first region, the curve is downward

sloping, with the long-run average cost per unit of output falling as the volume of output increases. Economies of scale exist in this region, related to increased efficiency from larger-scale operations and/or the ability to spread fixed overhead over a larger number of units of output. In the second region, the curve is horizontal, with changes in output having no impact on the average cost per unit. Average costs are at a minimum in this constant-cost portion of the curve, so that a firm will seek to have each of its facilities operate in this region. The third region is upward sloping, with diseconomies of scale. In this range of output, further increases in volume lead to increases in the average cost per unit. This may occur for a number of reasons, including the difficulty of managing and operating large-scale facilities. In the case of publicly produced and subsidized services, inappropriate pricing policies may lead to overuse and overproduction of services, driving average costs above the minimum level.

Superficially, production of Federal Reserve services appears to fit the mold of a decreasing-cost activity. The Federal Reserve is the largest single producer, nearly monopolizing production of many correspondent services, as its offices provide the major links in the nation's payments mechanism. Indeed, most Reserve banks, branches and offices operate at a relatively high volume of output, and many observers thus point to economies of scale as the explanation for the level of Federal Reserve involvement in correspondent banking.[9]

Figure 1
Standard Long-Run Average Cost Curve



Economies of scale, to the extent they exist, could help determine the future distribution of production between the Federal Reserve and the private sector. Increasing returns to scale could indeed give Reserve Banks a competitive advantage. If technology is relatively consistent across Reserve Bank facilities, increasing returns to scale would allow offices to increase output more than proportionately each time inputs are increased. Significant increasing returns to scale can often lead to the establishment of a natural monopoly — a single firm that accounts for all or nearly all of an industry's output. (Public utilities, with their large fixed capital investment, typically fall into this category.) This raises the question whether the Federal Reserve System's large volume of services makes it a lower-cost producer than correspondent banks, and thus justifies the System's disproportionate share of the production of correspondent services.

These propositions can be tested by estimating the long-run average-cost function — the long-run relation between a facility's average cost per unit of service supplied and its total costs for that service.[10] We estimated this function from Federal Reserve actual cost and output data for each facility, derived largely from the System's Planning and Control System of accounting (PACS). The data provide several alternative measures of average cost, depending on whether transportation and overhead costs are included.[11] The measures used here for check and ACH operations include both transportation and estimated overhead expenses. For coin and currency services, the average-cost measure includes estimated overhead expenses but excludes transportation expenses. For all services, however, similar results were found with alternative measures of average cost.

The general functional form of the estimated average-cost relation can be written as:

$$AC = a_0 + a_1V + a_2V^2 + a_3PM + a_4SAL + a_5REG \quad (1)$$

where

AC = average cost
V = volume of service produced
V^2 = volume squared (allows for a non-linear relationship between average cost and output)
PM = product mix, or type of service performed
SAL = salary index for Federal Reserve facilities
REG = regional and legal market characteristics

This function was estimated with cross-section data on average cost, volume, and other variables for Reserve Bank facilities for 1977. (An alternative log-linear version of this function was also estimated, but gave very similar results.)

This function, essentially a quadratic relation between average cost and volume, is "shifted" by certain regional conditions such as product mix (PM) or salary rates (SAL). This relation thus allows for the standard shape, whereby average costs first decrease and then increase with output, and allows also for steadily decreasing average costs. The exact shape of the curve, and the output level with minimum average costs, are determined by the coefficients of volume and volume-squared (i.e. a_1 and a_2).

We included the remaining terms to account for the impact of regional factors on variations in average costs for given levels of output. For example, check-clearing operations generally involve a *mix* of services in the sense that some types of checks cost considerably more to process than others. Thus, offices processing a relatively high proportion of such checks should, all other factors equal, report higher average costs than offices with less activity of this type. Since the product mix for check clearing can vary greatly between offices, we included a variable measuring the proportion of low-cost checks processed by each facility (PM) in the cost curve for this service.

Furthermore, since wages and salaries account for a major share of Federal Reserve costs of providing services, inter-regional wage differentials should affect the average costs incurred for any given volume of activity. In other words, facilities located in regions with higher salary levels, all other factors equal, will incur higher average costs than facilities in low-salary areas. For this reason, we included a variable measuring the relative level of salary rates for each facility (relative to the average).[12]

Finally, branch-banking restrictions, an important regulatory constraint, could also influence average cost by facility. Branching restrictions alter the structure of the banking market in a way that could result in increased utilization of Reserve Bank services. In states that restrict banks to a single operating unit, average costs per unit may be higher because Federal Reserve offices must provide services to a large number of small, geographically dispersed institutions. In states where branch banking is authorized, the large branch systems must provide many correspondent services for their branch offices directly, because they cannot rely on Reserve Banks to handle intrabank operations. In this manner, large branch banks may internalize many high-cost correspondent-banking operations. Branch banking, by reducing the proportion of high-cost services provided by Reserve Banks, thus could reduce the average costs of affected Reserve Banks, in relation to those incurred by Fed facilities in unit-banking states. However, the branching variables (tested in dummy variable form) were not statistically significant, and so were dropped from the reported equations.[13]

For each service, we selected a best equation from the possible combination of independent variables listed in the general equation. The simplified equations included measures of volume, as well as other factors (where suitable proxies were available) that contributed to the explanatory power of the equation (see Table 2).

Long-run Average Cost Curves

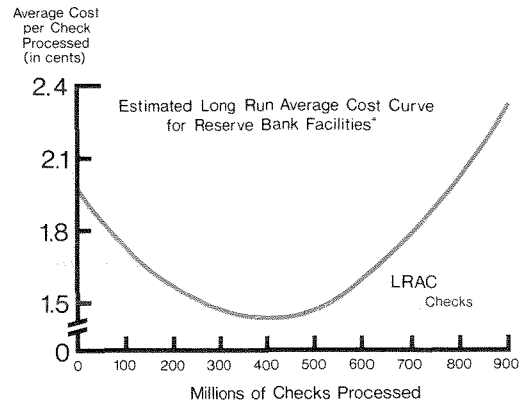
If economies of scale actually exist for Reserve Bank facilities, then we would expect to find a downward-sloping long-run average cost curve — rather than the traditional U-shaped curve — for check-clearing and check-

collection operations. In actuality, we found the reverse. The t-value of both volume measures, and the product-mix factor measuring the proportion of low-cost checks processed, were statistically significant (Table 2).

Thus, 1977 cost and output data do not support the argument that check clearing is a decreasing-cost activity for Reserve Bank facilities. Furthermore, all of the largest Reserve Bank operations were found along the upward-sloping portion of the U-shaped curve (see Chart 1). The estimated curve retained its U-shape even after exclusion of Chicago and New York, the two largest check-processing centers. The shape of the curve, as well as the location of many facilities, suggests that some smaller operations still operated in the region of increasing returns to scale. However, most of the larger facilities operated at too large a scale of operations, and thus produced check-clearing services inefficiently. Humphrey (1980) using a more sophisticated model, [illegible] similar evidence regarding diseconomies of scale.[14]

For automated-clearinghouse operations, in contrast, the estimated long-run average-cost curve appears to be downward sloping and linear (Chart 2). This indicates that average cost will decline as output rises, as found in Humphrey's 1980 ACH study.[15] This evidence of economies of scale in ACH services — which at present are almost entirely provided by the Federal Reserve System — is consistent with what might be expected in a developing

Chart 1
Check Clearing Services



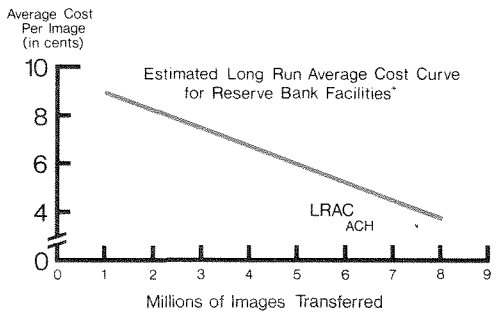
*Long-run average cost for check operations includes all production costs and estimated overhead costs. The 16-percent mark-up is not included.

Table 2
Federal Reserve Processing Costs

Independent Variables	Constant	V	V^2	PMLC	SAL	WRAP	r^2	Observations	Standard Error	Mean* Average Cost
Cost Per										
Check Processed (¢)	2.214 (15.93)	$-.2010\times10^{-5}$ (−2.96)	$+.2733\times10^{-11}$ (3.40)	$-.6656\times10^{-2}$ (−2.69)			.343	48	.2578	1.609
ACH Image Processed (¢)	9.768 (12.37)	$-.7388\times10^{-3}$ (−2.90)					.163	39†	3.124	7.997
Strap of Currency+ Processed (¢)	−13.41 (−.92)	$-.1526\times10^{-2}$ (−3.27)	$+.2872\times10^{-7}$ (2.55)		+45.49 (2.84)		.226	37	5.962	24.67
Thousand Pieces of Coin+ (¢)	−.2219 (−.01)	$-.1874\times10^{-4}$ (−2.79)	$+.2744\times10^{-11}$ (2.08)		+46.77 (1.26)	+17.46 (3.56)	.354	37	14.10	33.60

* Does not include 16-percent markup.
\+ Excluding transportation and shipping costs, which may vary significantly with the geographic area covered by each facility.
†Excludes Denver because of data problems.
V = Output or units of service produced
V^2 = V × V
PMLC = Product-mix variable. For check clearing, it refers to the proportion of low-cost checks processed by each facility.
SAL = Salary-adjustment factor.
WRAP = Facilities providing coin wrapping services (13 of 37). Dummy Variable.

Chart 2
Automated Clearinghouse Services



*Long-run average cost for ACH operations includes all production costs and estimated overhead costs. The 16-percent mark-up is not included.

industry. It also provides empirical justification for the Federal Reserve's decision to price ACH services at an estimated average cost based on a mature volume of services, rather than on costs at the present output level.

The cost data used in the regressions for coin and currency operations include the costs of receiving, verifying, and shipping preparation, but exclude the actual costs of shipping. These costs are most comparable to the reported fees charged by private correspondents, which also typically exclude transportation costs. But in a pricing environment, we should remember, the Federal Reserve will continue to provide non-transportation services without charge. Accordingly, the estimates presented here mainly indicate how well the Federal Reserve would compete with the private sector if it charged users for all costs incurred, as in the case of other services.

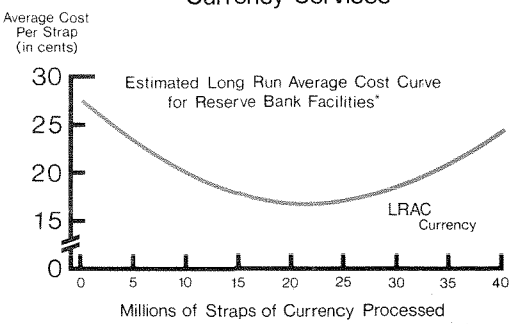
The estimated long-run average cost curves for both currency and coin operations included both volume measures, which were statistically significant in all cases. The relative salary measure (SAL) was also included. In addition, for coin services we included a dummy variable indicating whether a facility offered wrapped coin or only bagged coin. The estimates in Table 2 indicated higher average costs for any given volume at facilities that provided wrapping services.

The estimated long-run average cost curve derived for currency sevices is U-shaped (Chart 3). However, diseconomies of scale were evident only at the Federal Reserve Bank of New York, the System's largest producer, which provides nearly three times the volume of the next largest facility. If the New York operation is excluded, then the shape of the curve changes considerably, and some other large facilities also find themselves operating with diseconomies of scale.

The estimated long-run average cost curve for Reserve Bank coin-processing operations is also U-shaped (Chart 4). Some facilities operate in each of the three ranges of production — falling, relatively constant, or increasing average costs. Initially, average cost falls rather sharply as output rises, and indeed most Reserve Banks and their offices fall into this range. However, the medium-volume offices generally exhibit minimum average costs, while the highest-volume offices exhibit increasing average costs as volume rises.

Reserve Banks thus appear to operate with significant economies of scale throughout the present range of production for ACH services, but not for other services. Some check, and some coin and currency, operations operate at or near the estimated minimum average cost associated with the long-run average cost curve, while most smaller facilities could benefit from increasing returns to scale by expanding their output. In contrast, the largest

Chart 3
Currency Services



*Long-run average cost for currency services excludes shipping and transportation expenses, which may vary significantly between districts. All other production costs and estimated overhead are included in long-run average cost. The 16-percent mark-up is not included.

facilities all exhibit average costs above the minimum in coin, currency and check-processing operations. In addition, as their volume increases, so does their average cost. These findings refute the contention that Reserve Banks have a natural monopoly position by virtue of economies of scale in the production of their correspondent-banking services. Clearly, average cost does not continue to fall as output rises for check, coin, and currency services. Since Reserve Banks do not have natural monopolies, therefore, they can expect to encounter substantial competition from private suppliers even after the adjustment to pricing is made — a subject to which we shall now turn.

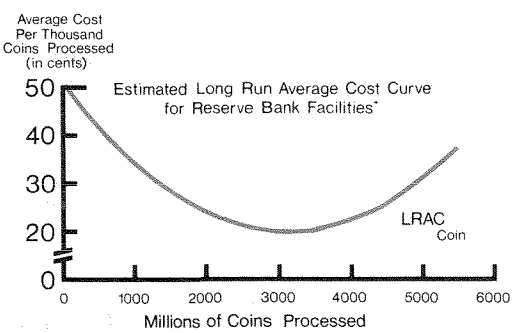
Price Comparisons

In the competitive atmosphere created by the MCA, the relative prices charged by Reserve Banks and private suppliers will be crucial in determining whether banks will purchase publicly- or privately-produced services. Short-run cost figures provide an indication of how much the volume of Reserve Bank services will rise or fall, relative to others, in the immediate wake of pricing. Long-run cost estimates give an indication of the competitiveness of Reserve Bank services following the initial adjustment to pricing and open access.

The evidence suggests that Reserve Banks are presently capable of producing check-clearing services at a cost comparable to, if not below, the fees set by private-sector producers. However, the data also suggest that the costs of providing coin and currency services are substantially higher for Reserve Banks than for their private competitors. This implies that Reserve Banks would have difficulty in competing, at least initially, if they tried to cover their full costs for these services — although of course they plan to charge only for transportation services. We do not attempt to compare prices and fees for ACH services because of the complementary, rather than competitive, nature of Reserve Bank and correspondent-bank services of this type.

Chart 4

Coin Services



*Long-run average cost for coin services excludes shipping and transportation expenses, which may vary significantly between districts. All other production costs and estimated overhead are included in long-run average cost. The 16-percent mark-up is not included.

We derived Reserve Bank "prices" for 1977 by summing all direct and indirect production costs, estimated overhead costs, and a 16-percent markup to cover imputed taxes and the return on capital. (The 16-percent figure is the markup used by the Board in its most recent pricing proposals.) We then compared these "prices" with correspondent-bank prices available from the 1977 Account Analysis Survey of the Federal Reserve Bank of Kansas City.[16] The survey provides estimates, by Federal Reserve District, on prices and/or compensating-balance requirements of 149 large correspondent banks. Our comparison (Table 3) indicates that Reserve Banks may find significant competition from the private sector after MCA implementation.

Check Pricing

The average (and modal) correspondent fee for a "typical" check amounted to 2.0 cents per item in 1977, compared to 1.87 cents per check for the Federal Reserve's average cost, including overhead and markup (Table 3). Despite considerable regional differences in both Reserve Bank and correspondent prices, the Reserve Banks' derived average-cost prices were lower than average correspondent fees in seven of twelve Federal Reserve Districts. On a national basis, Reserve Banks thus showed a slight advantage in 1977, and preliminary evaluation of 1979 data suggests that the advantage has been maintained.

Clearing of correspondents' checks through Federal Reserve facilities will become much

more expensive once Reserve Banks begin pricing check services. The increase in costs to correspondents is likely to be passed along to their customers. This factor of itself will increase the competitive advantage of Reserve Banks.

On the other hand, the largest Reserve Bank facilities suffer from operating in the region of diseconomies of scale. Humphrey (*Journal of Bank Research,* 1980) suggests that Reserve Banks would be unable to expand into the region of declining returns if they operated in a competitive environment.[17] If prices are set at the District or office level, they would be disadvantaged to the extent their average costs exceeded those of private suppliers. Over time, however, competition should reduce the scale of facilities operating above minimum average costs, thus reducing their average costs to a more competitive level.

Coin and Currency

Our average-cost measures for coin and currency services are not the same as those that the Federal Reserve intends to use for pricing. Rather, they represent the average cost of handling cash, i.e., handling and preparing it for shipment, and handling and storing it after receipt. The handling function is distinct from the transportation function. After implementation of the MCA, in contrast, Reserve Banks will begin pricing two types of services — transportation and shipping services, and coin-wrapping services.

Handling costs nonetheless help provide information on Reserve Banks' ability to provide non-transportation cash services on a competitive basis with the private sector. On the basis of a comparison which excluded shipping charges, we found that Reserve Bank costs were approximately one and a half times correspondent fees for coin-and-currency handling services (Table 3).

These higher costs reflected the Federal Reserve's governmental role. As the nation's central bank, the Fed has a responsibility for maintaining the quality of the nation's coin and currency. Reserve Banks all require storage and handling facilities for the new coin and currency that they distribute. They also have the task of filtering out unfit currency and coins, not to mention counterfeits, and removing them from circulation. Consequently, we cannot easily distinguish between the portion of handling costs which is strictly related to transferring cash between depository institutions, and the portion which is strictly governmental. This makes it difficult to determine whether Reserve Banks would be able to compete with private suppliers if they were to charge for the former type of services.

Table 3
Reserve Bank Costs and Correspondent Fees
(Based on 1977 data, in cents)

	Reserve Bank		
	Long-Run Average Cost[1]	Minimum Long-Run Average Cost[2]	Correspondent Average Fee[3]
Cost per encoded check	1.87	1.69	2.00
Handling costs			
Per roll of coin	3.85	n.a.	2.5
Per strap of currency	31.8	21.6	20.0
Transportation costs			
Per roll of coin	1.0	n.a.	n.a.
Per strap of currency	12.5	n.a.	n.a.

1. Long-run average costs are from 1977 Federal Reserve PACS Reports. Includes estimated overhead costs and the 16-percent markup.

2. Estimated minimum long-run average costs for check and currency services are from the equations reported on Table 2. The 16-percent mark-up is added to the minimum-cost estimate.

3. Correspondent prices are from the 1977 Account Analysis Survey, Federal Reserve Bank of Kansas City.

V. Correspondent Banking in the 1980's

The correspondent-banking environment of the 1980's, in the aftermath of the Monetary Control Act, should be increasingly competitive and more efficient. Competition may lead to some contraction in the amount of correspondent services provided by Reserve Banks to member banks, as pricing eliminates the former element of subsidy. On the other hand, Reserve Banks will be able to compete for the business of institutions that previously had no access to their services. Over time, production of these services should become more efficient as purchasers shift to lower-priced suppliers, regardless of whether those suppliers are private correspondents or Reserve Banks.

Despite the increases in competition and efficiency, prices for most types of correspondent services will rise in the short-run. Respondent banks will experience higher costs because of the elimination of subsidized Reserve Bank services. Obviously, respondent banks that formerly used free services will have to reevaluate the relative costs of providing services internally, or of purchasing them from correspondents and/or Reserve Banks. Correspondent banks that formerly used Federal Reserve services for their own and their respondents' benefit also will have to reexamine their production of correspondent-banking services in light of the new Reserve Bank charges. Thus, the MCA pricing scenario implies higher costs of using most services, whether provided directly by Reserve Banks, or indirectly by correspondents using Reserve Bank facilities.

In the long-run, the Federal Reserve's ability to operate like a private competitor will depend on its ability to adapt to market conditions, on its current costs relative to the costs and prices set by private competitors, and on its future costs as affected by economies or diseconomies of scale. Reserve Banks' pricing decisions are constrained by the MCA; but within those limits, they must develop market strategies and internal pricing and accounting systems. Their ability to compete also hinges on their ability to produce services in a manner, and at a level of cost, that maintains competitiveness in individual markets. Finally, the Fed will be pressed to take advantage of economies of scale, shifting production to facilities operating at or near minimum long-run average cost. That means adjusting their scale of operations where possible to reduce costs.

In the short-run, the MCA pricing environment may place some Reserve Banks at a competitive disadvantage vis-a-vis correspondents, as they learn to operate their correspondent-banking operations like "private" firms. Unlike their competitors, however, Reserve Banks have little or no experience in this area — making pricing, marketing, and service-quality decisions. But the MCA in effect requires the Reserve Banks to do just that; essentially it mandates the Federal Reserve System to provide services as if it were a private firm.

To maintain long-run competitiveness, Reserve Banks will have to overcome disadvantages associated with pricing — including the use of average cost pricing, which leads to a single price for each type of customer. While the *price* to all users in a specific region or group must be the same, the *cost* of supplying services to all those users will not be the same. Costs can vary among customers depending upon the customer's location, volume, or other factors. For example, although checks will be broken down into eight types for pricing purposes, pricing at a single average-cost derived price for each type will mean overcharging of low-cost users and undercharging of high-cost users.

In contrast to the pricing treatment mandated by the MCA, correspondents' charges for services may vary with each respondent, reflecting the actual cost of supplying services to individual customers. Thus, by charging fees based on actual costs, private correspondents may be able to take low-cost customers away from Reserve Banks. As lower-cost customers shift to privately produced services, the average cost of Reserve Bank-produced

services will rise, and Reserve Banks thus could find it difficult to price services competitively.

A second problem related to MCA implementation arises from the "postal service" or "cream skimming" dilemma. According to the "adequate level of service nationwide" provision in the legislation, Reserve Banks may be required to provide correspondent services to some customers whose location or volume might not interest private producers. Servicing these customers could boost Reserve Banks costs substantially. They must deal with the same type of problem faced by the U.S. Postal Service, in providing a nationwide level of services at prices that ignore substantial differences in the cost of providing similar services to different customers.

Correspondent banks could benefit significantly from the pricing of Reserve Bank services. In this situation, correspondents will no longer have to compete against "free" Federal Reserve services — and they will also have more flexibility in their operations than Reserve Banks, which must operate under MCA guidelines. Also, as in the past, correspondents will offer a broader package of services than Reserve Banks, such as loan participations, cash management, and Federal funds.

Future of Check Clearing

In the check-clearing area, large Reserve Bank facilities appear to be operating with average costs well above the estimated minimum average cost. This finding is not surprising, given the expected overuse of free check-clearing services provided by Reserve Banks. The largest check-processing facilities fall into the region of diseconomies of scale, or increasing average cost — which suggests that operations not subject to market pressures expanded beyond the region of constant returns to scale. In the post-MCA environment, these offices will have to reduce their operations, or open additional facilities to take advantage of lower average production costs associated with medium-scale operations. But Reserve Banks and Branches operating in the region near minimum average cost should be able to compete with correspondents on fairly equal terms.

With their overall price advantage on check services, Federal Reserve facilities should maintain a strong competitive position in the paper-check transfer market. The advantage is rather slight, however, so that the Fed cannot simply offer the service and let the market respond. Because their market is no longer assured, Reserve Banks must remain cognizant of the types of services provided by correspondents, and how those services are priced.

In the long-run, despite restrictions imposed by the MCA, Reserve Banks should continue to play a central role in the nation's payments system. And in the short-run, despite the impact of output changes on prices for check-clearing services, most Reserve Banks should be able to weather the shift to a pricing environment. For facilities operating in the range of relatively constant costs, even large changes in volume will not result in dramatic shifts in average costs, and hence in prices. Thus, Reserve Banks generally should survive the pricing-adjustment period successfully.

Future of ACH Services

The Federal Reserve faces a dilemma with respect to the pricing of ACH services — that is, the difficulty of setting an appropriate "long-run" price for this service that exhibits falling long-run average costs. In addition, despite the tendency for per unit average costs to fall in line with rising output, in 1977 the average cost per image (7.3 cents) far exceeded the average cost per check cleared (1.87 cents). That large gap still exists today. This differential could influence users to shift back to paper checks, unless other processing costs for ACH transfers remain well below comparable check costs.

The Federal Reserve, in its August 1980 proposals, thus based its proposed ACH prices on estimated *long-run* average costs at a much higher volume of output. As a result, the price per ACH transfer fell below the price per check. But despite the evidence from our 1977 study, significant economies of scale for ACH

operations may not continue indefinitely. So the future of this market could hinge on the prices set by the Federal Reserve. Too high a price could hamper the growth of the developing market for private ACH transfers, which now account for only one-fifth of the market. (Government transfers, which now account for the vast bulk of all transfers, will not be priced explicitly.) Too low a price, on the other hand, could create a large subsidy for the users of the Fed system, and again could retard development of a competitive private system.

Future of Cash Services

While pricing could lower Reserve Bank volumes for most services, it may actually increase the amount of coin and currency activity. The Federal Reserve's pricing proposals cover only transportation expenses — nearly one-third of the total for both coin and currency — so that Reserve Banks will continue to have an advantage over correspondents on the "price" for cash handling. With the opening of Reserve Banks' services to nonmember banks and other depository institutions, the Fed may actually experience an increase in volume in this activity. But while handling more currency and coin, Reserve Banks probably will provide fewer transportation services, since pricing eliminates the subsidy in this area.

VI. Summary and Conclusions

The inefficiencies and competitive barriers previously associated with the provision of correspondent-banking services helped bring about the enactment of the Depository Institutions Deregulation and Monetary Control Act. The pricing and access provisions of the Act were designed to rectify the major inefficiency in the nation's correspondent-banking market — the provision of free Federal Reserve services to member banks. Simultaneously, the Act attempted to strengthen competition among the suppliers of these services. The implementation of the Act over the next year will strongly influence the future of the correspondent-banking industry.

The overconsumption of free Reserve Bank services by member banks has led to overproduction by the public sector in general, and by some Reserve Bank facilities in particular. "Full cost" pricing as implemented under the MCA will not eliminate all of the subsidies to institutions using Fed services. However, it will provide Reserve Bank customers with market signals concerning the true cost of the resources they consume, providing strong incentives for more efficient use of the services produced.

The MCA was also designed to promote competition among suppliers of correspondent services by eliminating the segmentation of the market between member banks and other institutions. After implementation, all institutions will have access to Reserve Bank services, but of course at a price.

The post-MCA world will be both more competitive and efficient as a result of the partial or complete elimination of Federal Reserve subsidies to depository institutions. Removal of the check-processing and cash-transportation subsidies will allow private producers to compete on a more equal footing with Reserve Banks. For that matter, increased competition is also indicated by the evident lack of a natural Federal Reserve monopoly in check-processing or cash-handling services. In addition, historical data indicate that the charges Reserve Banks must set for their check services are comparable to the fees correspondents charged for similar services. In the long-run, competition from the private sector will probably erode the Federal Reserve's market share, but that competition should also spur Reserve Banks to produce at a more efficient scale of operations, leading to lower prices and higher quality of services.

In the ACH area, the Federal Reserve's published pricing schedule indicates a short-run willingness to continue subsidies, so that the market grows sufficiently for Reserve Banks to take advantage of their economies of

scale in this area. This would permit lower ACH transfer costs, making them more competitive with check clearing costs, and thereby helping to reduce the burden on the nation's check-payments system.

In the 1980's, therefore, the Federal Reserve System should continue as a primary producer, especially of check and ACH services. However, its overall role will be affected by the economy's increased reliance on the private sector for correspondent-banking services.

FOOTNOTES

1. Nonmember banks had access to Regional Check Processing Centers (RCPC's); access to Automated Clearinghouse (ACH) was open to all institutions.

2. The subject is covered in the following studies:

R. Alton Gilbert, "Utilization of Federal Reserve Bank Services by Member Banks: Implications for the Costs and Benefits of Membership," **Review** (Federal Reserve Bank of St. Louis, August 1977).

Susan R. Hume and Katherine S. Russell, "A Study of the Relative Usage of Federal Reserve Services by Member Banks in the Second Federal Reserve District," unpublished article (Federal Reserve Bank of New York, January 1978).

Bruce J. Summers, "Required Reserves, Correspondent Balances and Cash Asset Positions of Member and Nonmember Banks: Evidence from the Fifth Federal Reserve District," Working Paper 78-3 (Federal Reserve Bank of Richmond, April 1978).

3. A preliminary analysis of 1979 PACS data and correspondent-bank account analysis data indicates little change in the relationship between correspondent prices and average costs.

4. Federal Reserve Bank of San Francisco, "Federal Reserve Services," 1978, p. 3.

5. Board of Governors of the Federal Reserve System, **1977 PACS Expense Report, Annual Detail Reports,** (Washington D.C.: Federal Reserve Board, 1978), pp. 83-165; and **1977 PACS Expense Report, Annual Summary Report,** (Washington, D.C.: Federal Reserve Board, 1978).

6. U.S. Congress, **Public Law 96-221, Depository Institutions Deregulation and Monetary Control Act of 1980** (96th Congress, March 31, 1980), Section 11A, Pricing of Services.

7. These two items, imputed taxes and the imputed return to capital, are estimated by the Federal Reserve Board of Governors to be 16 percent of total costs. This provides the private-sector adjustment factor.

8. Federal Reserve Press Release, "Proposals for Pricing Federal Reserve Services" (Washington D.C.: Board of Governors of the Federal Reserve System, August 28, 1980), p. 4.

9. **Wall Street Journal,** "Fed's Plan to End Free 'Float' May Save Taxpayers' Money, Boost Costs to Banks," Thursday, August 21, 1980, p. 12; and Preston J. Miller, "The Right Way to Price Federal Reserve Services," **Quarterly Review** (Federal Reserve Bank of Minneapolis, Summer 1977), p. 20.

10. A preliminary evaluation of 1979 data indicates that similar long-run average cost curves continue to be the norm for each of the Reserve Bank services.

11. The following measures were estimated: average cost, which included all production and transportation costs, plus estimated overhead expenses; average cost less transportation expenses; average production costs (excludes overhead); and average production costs less transportation expenses. Overhead cost for each service and for each facility were estimated in direct relation to the proportion of production costs for each service at each Reserve District. This is the primary method of allocating overhead under the PACS accounting system.

12. Salary adjustment factors were taken from the Fourth Quarter, 1977, Federal Reserve Evaluation Program: Quantitative Performance Measures, Conference of First Vice Presidents, pp. 66-68. Since these measurements were not statistically significant, and bore the wrong sign for both check and ACH operations, they were not included in the final check and ACH equations presented in Table 2.

13. Branching variables were estimated in both dummy and interactive forms relating branching status and volume of services. Neither method produced significant results.

14. David B. Humphrey, "Economies to Scale in Federal Reserve Check Processing Operations," **Journal of Econometrics,** January 1981, pp. 168-169.

15. David B. Humphrey, "Scale Economies at Automated Clearinghouses," **Research Papers in Banking and Financial Economics** (Washington, D.C.: Federal Reserve Board, Revised March 1980), p. 2.

16. Robert E. Knight, **1977 Account Analysis Survey** (Kansas City: Federal Reserve Bank of Kansas City, Research Department, 1978), pp. 1-24.

17. David B. Humphrey, "Are There Economies of Scale in Check Processing at the Federal Reserve?" **Journal of Bank Research** (Park Ridge, Illinois: Bank Administration Institute, Spring 1980), p. 17

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