AN ANALYSIS OF FEDERAL RESERVE PRICING

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I. INTRODUCTION

In 1981 the Federal Reserve System adopted a new pricing policy for certain correspondent banking and other services, such as check clearing and settlement, supplied by Reserve Banks. The new policy was mandated by the Monetary Control Act of 1980, which gave all depository institutions equal access to Federal Reserve clearing services and required that prices charged for those services be set so as to reflect all costs of production, including an allowance for taxes, a return to capital, and all other expenses a private sector firm would bear.

Federal Reserve Banks have supplied correspondent banking services to the banking industry throughout most of their history. Before 1980 only member banks had direct access to all Federal Reserve clearing services. They received these services free of charge as partial compensation for the cost of the non-interest-bearing reserves they were required to hold. Private correspondent banks and clearinghouses supplied clearing services to nonmember banks and other depository institutions such as thrifts and credit unions.

When Congress granted equal access to Federal Reserve services it recognized that this action would put the Fed in more direct competition with private correspondent banks. The pricing requirements included in the act were intended to enable private firms to compete with the Fed. Pricing was also seen as a way of encouraging more rational resource utilization, since there was little incentive to conserve on the use of Fed services when no explicit prices were charged.[1]

This article describes and evaluates the pricing methods adopted by the Federal Reserve. Issues related to Fed pricing can be divided into two categories. The first pertains to the determination of imputed private sector costs; the second to the allocation of those costs to individual service prices. Sections II and III describe and analyze the methods used in cost determination, while Sections IV and V do the same for cost allocation. Conclusions are stated in Section VI.

II. IMPUTING THE COST OF CAPITAL TO THE FEDERAL RESERVE

The cost of capital is by far the most important of the costs the Federal Reserve must impute to its priced services, Accordingly, most of the analysis of cost determination focuses on capital financing costs. A detailed description of the methods used to determine imputed costs follows a review of some relevant aspects of the theory of capital finance.

Factors Determining the Cost of Capital

Capital goods, by definition, yield a stream of productive services over an extended length of time. The cost of capital refers to the price of capital services. As the name suggests, the cost of capital measures opportunity cost. It is the expected rate of return on alternative investment opportunities that bear the same amount of risk.

Investors in financial markets determine the cost of capital. Firms finance capital investment through the sale of financial assets such as equity shares, or stocks, and bonds. Market prices of those financial

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[1] Another reason Congress required the Fed to price certain of its services was to offset the cost to the U. S, Treasury of the lower reserve requirements brought about by the Monetary Control Act. Revenue considerations were not responsible for the legislative provisions requiring the Fed to recover imputed private sector costs, however. Instead, those provisions were intended to foster competition and promote efficient resource allocation, as noted in the text. A detailed account of the legislative debate over Federal Reserve pricing can be found in Anatoli Kuprianov, "The Monetary Control Act and the Role of the Federal Reserve in the Interbank Clearing Market," Federal Reserve Bank of Richmond, **Economic Review** 71 (July/August 1985): 23-35.

assets reflect the return on capital the firm is expected to earn. All other things equal, the lower the expected return the lower will be the market value of a firm's outstanding financial assets. Because investors typically demand a premium in exchange for greater risk, the cost of capital is higher for firms that undertake riskier investments.

A firm's cost of capital can be expressed as the total expected return to investors divided by the market value of outstanding financial assets. That ratio, in turn, can be expressed as a weighted average of the expected rate of return to equity and the interest rates paid on outstanding debt.

In a market economy prices allocate resources. The cost of capital, as determined in financial markets, determines how capital is allocated. A firm will invest in capital if the expected rate of return on investment is at least equal to the cost of capital at the margin ; otherwise, the market value of its outstanding equity will fall until the expected rate of return to shareholders once again equals the expected return on other investments bearing equivalent risks. Assuming firms attempt to maximize their market value, capital will be allocated to investments with the highest expected return for a given amount of risk. A firm that is unable to earn a rate of return at least equal to its cost of capital over the long run will experience difficulty in attracting capital from investors.

The Cost of Capital to the Federal Reserve

Federal Reserve Banks, because of their unique status as quasi-governmental agencies, are not subject to the same market forces confronting private firms. Although they are legally privately owned institutions, their stock is issued only to member banks and cannot be bought or sold in financial markets. Moreover, dividends paid on that stock are fixed by law at a six percent annual rate, with all remaining revenues net of expenses turned over to the U. S. Treasury. Thus, unlike a purely private firm, the cost of capital to the Fed is not determined in financial markets. Nevertheless, capital acquired by the Fed does have an opportunity cost. For capital used in the production of priced clearing services, that opportunity cost is reflected in the cost of capital faced by its competitors in the private sector.

Capital Structure Assumptions

Total imputed financing costs for Federal Reserve priced service operations are determined by the asset base (the value of capital assets devoted to priced services), the assumed capital structure (the proportions of equity and debt used to finance the asset base), and the imputed rate of return to equity and interest rates on debt. Table I summarizes the capital structure assumptions applied to the priced services asset base. Overall capital structure is determined by matching different types of assets with separate funding sources. This *matched-book capital structure,* as it is termed, treats long-term assets as being financed by a mix of equity and long-term debt, while short-term assets are assumed to be financed by short-term debt.

Assets classified as long-term are physical assets, such as buildings and equipment. Short-term assets consist of working capital; that is, funds needed to conduct a firm's day-to-day transactions. Prepaid expenses, materials and supplies, and receivable accounts reflect such funding needs.

Imputed financing costs for the assets listed in Table I are recovered using two different methods. The Fed distinguishes between assets directly related to the production of priced clearing services and other assets used to facilitate the clearing and settlement of payments transactions. Financing costs for long-term assets and working capital are determined using a financial model of large bank holding companies and recovered through a mark-up added to service prices. Self-financing assets earn separate and identifiable income streams apart from the fee income earned from the sale of priced clearing services.

Two types of self-financing assets are listed in Table I. The first is Federal Reserve float. The cost of float is largely recovered through separate charges against institutions that receive credit for checks and other items before the Fed receives the funds for those items. Clearing balances are deposits held with Reserve Banks (in addition to required reserves) to facilitate the transfer of funds associated with the transactions they process.[2] Funds obtained from clearing balance deposits are assumed to be invested in short-term government securities. This

[2] Although the Monetary Control Act imposes uniform reserve requirements on all depository institutions, some institutions may not hold sufficient reserves directly with Reserve Banks to facilitate clearing and settlement. Situations such as this can arise because reserve requirements can be satisfied by vault cash holdings or by reserve accounts, known as pass-through reserve accounts, administered by private correspondent banks for their respondents. Institutions are required to hold separate clearing balance deposits as a condition for receiving Fed services in these cases to prevent the occurrence of overnight overdrafts. Banks that otherwise hold sufficient reserves for clearing purposes can also hold clearing balances in addition to required reserves.

Table I

THE MATCHED CAPITAL STRUCTURE ASSUMPTION

ASSETS:	FINANCED BY:
Long-Term	
Premises	Equity and long-term debt[1]
Furniture and equipment	
Leases and leasehold improvements	
Short-term	
Working Capital:	
Receivables	**Short-term debt[1]**
Materials and supplies	
Prepaid expenses	
Self-Financing Assets:	
Net items in the process of collection (float)	**Balances arising from early credit of uncollected items[2]**
Imputed reserve requirements	**Clearing balances[3]**
Investment in marketable securities	

1 Imputed financing costs determined using the bank holding company model.

2 Imputed cost is the federal funds rate.

3 Cost of funds determined by the earnings credit rate paid on clearing balances deposited with Federal Reserve Banks.

Source: Board of Governors of the Federal Reserve System, "Financial Results of Federal Reserve Priced Services Operations," (November 20, 1985).

assumption is reflected in the two asset accounts corresponding to clearing balance liabilities in Table I. The Federal Reserve pays implicit interest on designated clearing balances in the form of earnings credits that can be used to pay for its priced services. Imputed earnings on the funds placed in the corresponding asset accounts offset the cost of these earnings credits to the Federal Reserve. The treatment of self-financing assets is described in greater detail at the end of this section.

The Bank Holding Company Model

A financial model of large bank holding companies is used to impute a cost of capital to the Federal Reserve. The bank holding company model adopted by the Fed uses financial data on the twenty-five largest bank holding companies in the United States to estimate the average pre-tax rate of return on capital for the sample.[3] That estimated rate of return is then used to determine a targeted rate of return on long-term assets and working capital. As noted above, imputed financing costs for these two categories of assets are recovered through a mark-up added to service prices.

The resulting targeted rate of return is a pre-tax rate. It reflects both the imputed after-tax rate of return and corporate income taxes that would be levied against the pre-tax return. The pre-tax rate of return to capital can be expressed as a weighted average of the pre-tax rate of return to equity and the interest rates paid on outstanding debt. Formally stated, that expression is

$$r = a_1 \left(\frac{r_1}{1-t}\right) + a_2 r_2 + a_3 r_3,$$

where the variable r represents the aggregate pre-tax rate of return to capital, r_1 the after-tax rate of return to equity, t the average corporate tax rate, r_2 the average interest rate paid on long-term debt, r_3 the average short-term interest rate, and a_1, a_2, and a_3 the proportions of equity, long-term debt, and short-term debt used to finance capital investment.

Accounting data taken from the financial statements of the bank holding company sample are used

[3] Because of unique circumstances, one of the twenty-five largest bank holding companies was removed from the sample used to calculate the targeted rate of return for 1986, and another holding company was substituted in it place. 50 **Federal Register** 47,624 (November 19,1985).

to construct an estimate of the average pre-tax rate of return. An estimated rate of return calculated on the basis of accounting data is termed a *book* rate of return. Book rates of return can be contrasted with market rates, which are calculated using market data on actual returns earned by investors. A formal derivation of the rate of return formula used in the bank holding company model is presented in the shaded box on the opposite page. A description of how the variables appearing in that formula are calculated follows.

The procedure used to determine the average rate of return earned by the bank holding company sample can be divided into three steps. First, the pre-tax rate of return to equity, $r_1/(1-t)$, is estimated. This term measures both the cost of equity finance and corporate income taxes. Second, interest rates on long-term debt, r_2, and short-term debt, r_3, are estimated. Third, the assumed financial structure (reflected by the weights a_1, a_2, and a_3) is determined.[4]

The Pre-Tax Rate of Return to Equity Determining the pre-tax rate of return to equity requires three steps. In the first step the after-tax rate of return is calculated by dividing after-tax profits by the book value of outstanding equity. This yields an estimate of the variable r_1.

Average corporate income tax rates are estimated by dividing actual taxes paid, with an adjustment that adds back the tax benefits that banks get from holding municipal bonds, by gross income. Deferred taxes are excluded from the estimated tax rate. The imputed tax rate is then determined as a weighted average of the estimated tax rates for each of the holding companies in the sample. The weights used to compute the sample average are individual holding company profits divided by total profits for the entire sample.

Finally, the pre-tax rate of return to equity is determined by dividing the after-tax rate, r_1, by (l-t), where t denotes the average tax rate. The values of r_1 and t used in this final step are three-year moving averages of the sample averages.

Interest Rates An imputed interest rate on long-term debt is determined by averaging the interest rates paid on all outstanding long-term debt for the holding companies sampled. The short-term interest rate is estimated in the same way, except that demand deposits and other deposits subject to interest rate ceilings are excluded from the calculation. Because banks often pay implicit interest in the form of free gifts or services for deposits subject to interest rate ceilings, explicit interest rates provide downwardly biased estimates of the true cost of these funds. Since implicit interest payments are difficult to estimate, all such deposits are excluded from the calculation of the cost of short-term debt finance.

Capital Structure The weights a_1, a_2, and a_3 appearing in the bank holding company rate of return formula are determined on the basis of the matched-book capital structure assumption described earlier. Long-term assets are assumed to be financed by a mix of equity and long-term debt. Proportions of equity and long-term debt, represented by the variables a_1 and a_2, are based on the corresponding proportions observed for the bank holding company sample. The sum $a_1 + a_2$ is determined so as to equal the proportion of long-term assets in the bank holding company model asset base, which is composed of long-term assets and working capital. The variable a_3 is the share of working capital in the asset base. The cost of finance for working capital is r_3, the short-term interest rate.

Other Imputed Private Sector Costs

The estimate of the pre-tax cost of capital obtained using the bank holding company model includes an imputed allowance for the cost of corporate income taxes. However, Federal Reserve Banks, because of their nonprofit status, are also exempt from certain sales taxes that private firms are required to pay. A separate allowance for such taxes is therefore added to the total cost recovery target.

Other imputed expenses include an allowance for federal deposit insurance assessments, based on total clearing balances, and Federal Reserve Board staff expenses attributable to priced services development. As part of this last allocation, a portion of Board assets are added to the priced services asset base.[5]

4 Information on the bank holding company model was gathered from a series of **Federal Register** notices published by the Federal Reserve Board: 46 **Federal Register** 1,338 (January 6, 1981); 49 Federal Register 11,251 (March 26, 1984); 49 **Federal Register** 44,556 (November 7, 1984); and 50 **Federal Register** 47,624 (November 19, 1985).

[5] 49 **Federal Register** 11,251 (March 26, 1984).

The Rate of Return to Capital as a Weighted Average of Interest Rates and the Return to Equity

The financial model of large bank holding companies used by the Federal Reserve to determine its imputed cost of capital is based on a formula that breaks down the aggregate rate of return to capital into a weighted average of the pre-tax rate of return to equity and the interest rates paid on long- and short-term debt. In the derivation that-follows, all variables represent accounting data that appear in bank holding company financial statements.

Consider a firm that finances its investments by issuing a mix of equity shares, long-term debt, and short-term debt. Let the variable s represent the book value of the firm's outstanding equity, b_1, the book value of long-term debt, and b_2 the value of short-term debt., The aggregate book value, v, of all claims against the firm's revenues is

$$v = s + b_1 + b_2 .$$

Now let the variable q denote revenues net of operating expenses. The pre-tax book rate of return to capital, represented by the variable r, is the ratio of pre-tax earnings to the aggregate book value of all claims held by investors against the firm's income stream. In formal terms,

$$r = \frac{q}{v} .$$

Taxable profits, denoted by the variable π, are determined by subtracting total interest payments on outstanding debt from net before-tax revenues. If c_1 and c_2 represent outstanding interest payment obligations on long- and short-term debt, then taxable profits are

$$\pi = q - c_1 - c_2 .$$

After-tax profits are $(1-t)\pi$, where t represents the corporate income tax rate.

Using the definition of taxable profits, the pre-tax rate of return to capital can be alternatively stated as

$$r = \frac{\pi + c_1 + c_2}{v} .$$

The last expression can be restated as a weighted average of the pre-tax rate of return to equity and the average yields paid on long- and short-term debt, To see this, first note that the pre-tax rate of return to equity, denoted by the variable r_e, is the ratio of pre-tax profits to the value of outstanding equity. Formally,

$$r_e = \frac{\pi}{s} .$$

The average yields on long-term debt, r_2, and short-term debt, r_3, are defined as

$$r_2 = \frac{b_1}{c_1}$$

and

$$r_3 = \frac{b_2}{c_2} .$$

Now let a_1, a_2, and a_3 denote the proportions of equity, long-term debt, and short-term debt the firm uses to finance its investments. By definition,

$$a_1 = \frac{s}{v}$$

$$a_2 = \frac{b_1}{v}$$

$$a_3 = \frac{b_2}{v} .$$

Using these definitions, the pre-tax rate of return to capital can be expressed as

$$r = a_1 r_e + a_2 r_2 + a_3 r_3 .$$

As a final step, let $r_1 = (1-t)\pi/s$ denote the after-tax rate of return to equity. Then, the pre-tax rate of return can be expressed as a function of the after-tax rate,

$$r_e = \frac{r_1}{1-t} .$$

Substituting this last expression into the weighted average rate of return formula derived above yields

$$r = a_1 \left(\frac{r_1}{1-t}\right) + a_2 r_2 + a_3 r_3 ,$$

which is the formula stated in the text.

Self-Financing Assets

Three of the asset accounts listed in Table I are classified as self-financing: float, imputed reserve requirements on clearing balances, and investment in marketable securities. How financing costs for these assets are determined and recovered are described below.

Clearing Balances The accounts labeled imputed reserve requirements on clearing balances and investment in marketable securities shown in Table I stem from clearing balances deposited with Reserve Banks by commercial banks and other depository institutions. Clearing balances held on deposit with the Federal Reserve earn interest in the form of earnings credits that can be used to pay for clearing services. Earnings credits accruing to clearing balances are computed at a rate of interest that approximates the competitive rate private correspondents would pay on equivalent deposits. That interest rate is determined using the prevailing federal funds rate, with an adjustment to reflect the marginal cost of the added reserve requirements a correspondent bank would be required to hold against such deposits. According to calculations performed by the Federal Reserve Board staff, this adjustment reduces the rate paid on clearing balances by seven percent.[1]

Correspondent banks are subject to a twelve percent required reserve ratio on balances deposited by their respondents. Accordingly, twelve percent of the funds the Federal Reserve receives from clearing balance deposits are allocated to the imputed reserve requirements account, which is assumed to earn no interest. The remaining funds are allocated to the investment in marketable securities account. Funds in that account are assumed to be invested in three-month Treasury bills.

Float Float is created when the Federal Reserve makes the funds from a payments transaction available to a receiving bank before they are obtained from the payor. As such, it represents an extension of credit to the banking system and is included as a short-term asset on the balance sheet of the Federal Reserve. Almost all float results from check-clearing activities, although small amounts can also arise from automated clearinghouse (ACH) transactions.[2]

The Monetary Control Act classifies float as a separate service subject to pricing. It requires float to be valued at the prevailing federal funds rate and recovered through pricing. The cost of float is recovered by a number of different methods depending on the factors responsible for its creation and the choice of payments options depository institutions make.

Funds for checks cleared through Federal Reserve offices are made available according to fixed availability schedules. For example, funds for checks drawn against institutions in the same district are typically made available to the receiving institution on the next business day. When machinery breakdowns or transportation delays interrupt the scheduled collection of funds for checks drawn against banks in the same district, the cost of the resulting float is added to overhead expenses and recovered through check collection fees.[3]

[1] Although the marginal reserve requirement for correspondent banks is twelve percent, deposits held with a correspondent are subtracted from a respondent bank's reservable liabilities. The Federal Reserve Board has argued that this subtraction effectively raises the rate of interest paid on such deposits and adjusts the rate paid on clearing balances accordingly. 49 **Federal Register** 11,251 (March 26, 1984).

[2] A very small amount of float is also created in connection with wire funds transfers and the transfer of book-entry securities. Float arising from these types of transactions can be either debit or credit float, which means that the cost to the Fed can be negative. For practical purposes, the net amount of such float is negligible.

[3] 48 **Federal Register** 10,753 (March 14, 1983).

III. EVALUATION OF THE BANK HOLDING COMPANY MODEL

Two ultimate goals underlie the pricing policy for Federal Reserve services mandated by the Monetary Control Act. The first is to give private sector firms an opportunity to offer competing services. The second is to bring about an efficient use of economic resources.

To be able to compete with the Federal Reserve, private firms must perceive an opportunity to earn a rate of return at least equal to their cost of capital.

Other types of float are charged directly to the parties receiving the resulting extension of credit. Institutions that close during midweek must pay the cost of float generated by such closings.[4] Banks receiving early credit for checks drawn against banks in other districts must pay for the resulting float.6

Because ACH transactions are not affected by the same factors that can delay check collection, ACH float is a smaller problem than check float. When data processing problems or network transmission delays result in the creation of ACH float, the associated costs are allocated to ACH overhead expenses and recovered through service fees. Float resulting from midweek closings is priced in much the same way as check float in corresponding cases.[6]

Financial institutions can choose among one of two payments options for float. They can either authorize the Fed to directly debit their reserve or clearing accounts for the cost of float arising from interterritorial check deposits or from midweek closings, or they can have their reserve or clearing account balances adjusted after the fact by the amount of float received over that period. These "as of" adjustments, as they are termed, reduce the amount of earnings credits paid on clearing balances or, alternatively, require holding higher required reserve balances in subsequent days to meet average reserve requirements.

[4] Nonstandard holidays are treated differently from midweek closings, however. Nonstandard holidays are state holidays during which Federal Reserve Banks and most banks nationwide are open for business. In cases where banks are legally required to close for a state holiday, credit to the sender of an item is deferred to the next business day, 12 C.F.R. Part 210 (Regulation J, Collection of Checks and Other Items and Wire Transfer of Funds).

[5] 48 Federal Register 10,753 (March 14, 1983).

[6] 49 Federal Register 6,564 (February 22, 1984).

That opportunity can exist only if the targeted rate of return to capital incorporated into Federal Reserve service prices reflects the cost of capital faced by its potential competitors.

A pricing policy that encourages competition is also efficient from the standpoint of economic theory. The cost of capital is, by definition, the opportunity cost of capital. An opportunity cost is the cost of foregone alternatives. In a market economy decisions regarding resource allocation are based on perceptions of relevant opportunity costs. When prices reflect true opportunity costs, they give purchasers incentives to use different goods and services only so long as the value they place on those items is at least as great as the cost to society of producing them. The resulting outcome is efficient in the sense that it allocates resources to the production of goods and services most valued by market participants.

These considerations suggest that the bank holding company model can be evaluated on the basis of how well it estimates the cost of capital faced by private firms that compete with the Federal Reserve. That evaluation criterion is adopted in the following analysis.

Evaluation Criteria

Determining the appropriate targeted rate of return to capital poses a number of difficult methodological problems. These problems, however, are not unique to the Federal Reserve. Regulatory agencies such as public utility commissions have long been faced with a similar task. These agencies attempt to determine service prices that permit regulated firms to earn rates of return high enough to attract capital without yielding monopoly profits.

The pricing methodology adopted by the Federal Reserve closely resembles the rate-setting methods commonly used by regulatory agencies. Rate-setting methods for regulated industries have received a great deal of attention from economists. It seems reasonable, therefore, to apply the same evaluation standards developed to analyze public utility pricing to the methodology adopted by the Federal Reserve.

Kolbe, Read, and Hall have proposed two theoretical evaluation criteria for analyzing rate-setting methods used in public utility regulation.[6] The first is a test for consistency with economic theory. This test looks at the assumptions and procedures used to estimate the cost of capital to determine whether they are consistent with accepted economic theory. The second criterion is a test of the logical consistency of the rate-setting procedure. Its purpose is to determine whether a rate-setting procedure can be logically expected to achieve certain goals.

[6] A. Lawrence Kolbe and James A. Read, Jr, with George R. Hall, **The Cost of Capital, Estimating the Rate of Return for Public Utilities** (Cambridge: The MIT Press, 1984), chap. 3.

Consistency with Economic Theory

Consistency with economic theory is a useful evaluation criterion because theory identifies the opportunity costs relevant to decisions affecting resource allocation. A great deal of published data, especially accounting data, measure historical costs rather than opportunity costs. Because market conditions change over time, historical cost data generally provide poor estimates of current opportunity costs. Unfortunately, exact measures of opportunity costs, such as the cost of capital, are not always available. In such cases, economic theory can be used to develop estimation methods that are free from systematic bias. Viewed from this perspective, the purpose of the test for consistency with theory is to determine whether a rate-setting procedure utilizes the best available methods to estimate true opportunity costs.

The Difference between Realized Returns and the Cost of Capital As noted earlier, the pre-tax cost of capital can be expressed as a weighted average of the expected pre-tax rate of return to equity and the interest rates paid on debt issued to finance new investment. The cost of capital differs from the realized return to capital in that it is an expected rate of return. Using the notation developed earlier, the pre-tax weighted average cost of capital can be expressed as

$$E(r) = a_1 \left[\frac{E(r_1)}{1-t}\right] + a_2 r_2 + a_3 r_3 ,$$

where now E(r) denotes the expected aggregate pre-tax rate of return to capital, or cost of capital; $E(r_1)$ the expected return to equity, which measures the cost of equity; t the marginal tax rate on new investment; r_2 and r_3 the interest rates paid on long- and short-term debt issued to finance new investment; and a_1, a_2, and a_3 the targeted proportions of debt and equity used to finance new investment.

The bank holding company model uses historical returns to estimate the cost of capital. Two implicit assumptions underlie that approach. The first is that the average historical book rate of return yields good estimates of the past cost of capital to the banking industry. The second is that the historical cost of capital can be used to infer the cost of capital currently faced by its private sector competitors. Whether these assumptions are justified can be determined by examining available evidence on the behavior of capital markets.

There are a number of reasons why the cost of capital can differ from historical rates of return. First, past returns to equity can differ from the expected rate of return. Second, fluctuations in market interest rates change the cost of issuing new debt. Third, tax laws do not, as a general rule, treat different types of capital investment equally ; moreover, those laws are periodically revised so that effective marginal tax rates on new investment can differ from tax rates on past investment. Finally, financing decisions, reflected by the weights a_1, a_2, and a_3, may differ at the margin for new investments. Each of these issues must be considered in evaluating different methods of estimating the cost of capital.

Estimating the Cost of Equity As residual claimants to the income earned by a firm, shareholders bear two types of risk. Business risk refers to the risk inherent to the activities a firm engages in ; i.e., risk stemming from capital investment. Financial risk is created when investment is financed by borrowing. The more highly leveraged a firm is the more variable are rates of return earned by shareholders and the greater is the risk of default. Both of these sources of variability in earnings determine the risk premium demanded by shareholders. Firms that bear similar business and financial risks should, according to theory, face the same cost of equity.

The bank holding company model estimates the historical cost of equity to large holding companies by averaging past realized rates of return earned by a sample of firms. Two implicit assumptions underlie that approach. The first is that the cost of equity faced by the nation's twenty-five largest holding companies is the same. The second is that expected rates of return to equity equal subsequent realized rates on average. The last assumption is commonly made in economic research and, at least in the case of market equity returns, appears to be empirically justified.[7]

Because changes in market conditions can cause rates of return to fluctuate over time, the bank holding company model uses a three-year average of past rates of return to determine the imputed cost of equity. Basing the imputed cost of equity on a simple average of historical rates assumes that the cost of equity is constant over the sample period. The last

[7] Studies have found that capital markets are efficient in the sense that market prices of financial assets fully incorporate all publicly available information about the firms issuing those securities. Under certain assumptions, market efficiency implies that discrepancies between realized and expected rates of return should be zero on average. See, for example, Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," **The Journal of Finance** 25 (May 1970): 383-417. A more recent survey can be found in Thomas E. Copeland and J. Fred Weston! **Financial Theory and Corporate Policy,** 2d ed. (Reading, Mass.: Addison-Wesley Publishing Company, 1983), chap. 10.

assumption is a strong one, but has some empirical justification. Studies have found that market rates of return for virtually all firms whose stocks trade in organized markets are uncorrelated over time. Eugene Fama has noted that such behavior is consistent with the joint hypothesis that markets are efficient, in the sense that expected rates equal realized rates on average, and that the expected rate of return to equity is constant over time.[8]

An alternative approach more commonly used to estimate the cost of equity to firms is based on the Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model specifies rates of return to risky assets as a function of their covariance with a diversified market portfolio. A principal result of that model is that only undiversifiable risk, that is, the portion of the variation in equity returns correlated with the returns to a fully diversified market portfolio, determines the risk premium demanded by shareholders. In recent years the Capital Asset Pricing Model has gained increasing acceptance in public utility rate-setting hearings.

More recently, Arbitrage Pricing Theory has begun to replace the CAPM as the dominant analytical framework used in research into capital market behavior. Arbitrage Pricing Theory is more general than the Capital Asset Pricing Model in that it relates equity returns to a number of other factors in addition to the return earned on a diversified portfolio. As with the CAPM, Arbitrage Pricing Theory can be used to estimate the cost of equity to firms. The CAPM can be viewed as a special case of Arbitrage Pricing Theory.

The above discussion has assumed that market rates of return are used to estimate the cost of equity. As noted earlier, however, the bank holding company model uses book rates of return based on accounting data. Differences between book rates of return and market rates are examined below.

Measuring Returns to Equity Market rates of return earned by shareholders are the sum of the dividend yield, the ratio of dividends to the market value of equity, and any capital gains or losses to shareholders resulting from changes in the market value of equity. Market rates of return are the theoretically correct measure of shareholder earnings. Book rates of return typically differ from market rates. Kolbe, Read, and Hall note two principal reasons for these discrepancies.

First, the market value of a firm's equity will typically differ from its book value. Although there is reason to believe that investors' expectations are correct on average, realized returns in specific cases can differ markedly from initial expectations. When a firm's earnings fall short of expectations, for example, the market value of its outstanding equity falls until the expected rate of return to equity is once again equated with the cost of equity. Thus, when market value is less than book value the book rate of return will tend to understate the true rate. Conversely, when market value exceeds book value the book rate overstates the true rate.

Second, book rates of return use accounting profits to measure the return to equity. Accounting profits may differ systematically from true economic returns, however. Standard accounting procedures typically do not recognize changes in asset values, except when assets are disposed of. Moreover, depreciation schedules used in standard accounting practices are arbitrary from an economic point of view. To the extent that accelerated depreciation schedules used for tax purposes overstate the true rate of depreciation, for example, accounting profits may understate profits. Finally, generally accepted accounting principles allow considerable discretion in the way income can be reported. It is thus theoretically possible for two firms that earn the same true incomes to report quite different accounting profits. Moreover, there is no evidence that these discrepancies will cancel out on average.[9]

It would be a straightforward task to incorporate market rates of return into the bank holding company model. Available evidence suggests that market rates would yield better estimates of the cost of capital than book rates.

The Cost of Borrowing Unlike the expected return to equity, data on market interest rates are readily available. Interest rates paid on debt contracted in the past do not reflect the cost of borrowing *to* finance new investment: current market interest rates do. Therefore, estimates of the cost of capital should be based on currently prevailing market interest rates.

Measuring Effective Tax Rates Tax laws stipulate both a legal or statutory tax rate and rules that specify how taxable income for a firm must be computed. Accounting conventions required by tax laws

[8] See Eugene F. Fama, **Foundations of Finance** (New York: Basic Books, Inc., 1976), chap. 5.

[9] Kolbe, Read, and Hall, **The Cost of Capital,** pp.

do not measure true economic costs, however. Depreciation schedules used for tax purposes, for example, rarely correspond to true economic depreciation. Consequently, effective tax rates can differ systematically from statutory rates. Effective tax rates can be either higher or lower than statutory rates, depending on whether depreciation schedules used to compute taxable income understate or overstate true depreciation.

Special tax concessions, such as the investment tax credit on purchases of new machinery and equipment, also influence effective tax rates. Investment tax credits act to lower effective marginal tax rates on income earned from such investments.

Thus, although the maximum statutory tax rate on corporate income is 46 percent, recently liberalized depreciation allowances and investment tax credits produce effective marginal tax rates on income from new investment that are much lower. A recent study by the U. S. Treasury reports estimates of effective marginal tax rates in the range of -8 to 20 percent on equipment and 40 percent on structures.[10]

The bank holding company model uses average tax rates, calculated as the ratio of taxes actually paid (with an adjustment that adds back the tax benefits banks receive from holding municipal bonds) to pre-tax profits, to estimate the effective tax rate for the holding company sample. As with the imputed cost of equity, the imputed tax rate is based on a three-year average of estimated historical tax rates for the bank holding company sample. For 1986 the imputed tax rate is 37.6 percent.[11]

While average tax rates do reflect the aggregate effects of depreciation allowances and investment tax credits on total taxes paid by firms, they do not necessarily measure effective marginal tax rates on income from new investment. Research on corporate income taxation reveals that average tax rates have systematically overstated effective marginal tax rates in recent years. An article by Alan Auerbach has analyzed the reasons for this finding.[12] Three factors discussed by Auerbach are relevant to the evaluation of the Federal Reserve's method of imputing taxes.

First, some firms may earn a rate of return to capital that is in excess of a competitive return. Such excess returns may reflect the entrepeneurial ability of management or the exercise of market power rather than a return to capital. To the extent that these excess returns do not come from depreciable capital, they face a marginal tax rate of 46 percent. Auerbach argues that the taxation of excess returns is not directly relevant to the incentives to invest in fixed capital, but is incorporated in measured average tax rates.

Second, average tax rates reflect effective tax rates on different vintages of capital. The Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982 have reduced effective tax rates on income from depreciable capital below rates prevailing in the pre-1981 period. Capital acquired before these tax law changes is effectively taxed at higher rates than those applied to new capital investment. Moreover, the depreciation allowances permitted for tax purposes tend to overstate true economic depreciation. Compared to true income, taxable income is lower during the early years of an asset's life and higher in later years. As a result, effective tax rates on income from older vintages of capital tend to be higher than those on new investment. Estimates of effective tax rates based on accounting data measure the average tax rate on different vintages of capital and thus do not accurately reflect the lower effective tax rate on income from new investment. The practice of averaging estimated tax rates over time further exacerbates this problem.

The third and final point deals with asymmetries in the treatment of gains and losses. While corporate earnings are taxed at a positive rate, the tax on operating losses, which are negative earnings, is zero. Firms that operate at a loss are unable to exploit tax preference such as the investment tax credit. Thus, average tax rates overstate the effective marginal tax rate on new investment. While firms that incur losses do have limited options to carry those losses over, such options do not correct for the bias introduced by the asymmetric treatment of gains and losses.

To conclude, estimates of tax rates that are based on accounting data do not measure the effective marginal tax rate on income from new investment. The relatively higher tax rates on income from past capital investment reflected in such data represent sunk costs, which are not relevant for current investment decisions. Imputed tax rates applied to Federal

[10] These estimates apply to equity-financed investments and assume a four percent real rate of return to equity and a five percent inflation rate. Effective tax rates for different types of equipment vary with depreciable lifetimes; effective tax rates are generally higher for assets with longer depreciable lifetimes. In addition to longer depreciable lifetimes, structures face a higher effective tax rate because they are not eligible for the investment tax credit. U. S. Treasury Department, **Tax Reform for Fairness, Simplicity, and Economic Growth,** vol. 2 (November 1984), p. 156.

[11] 50 **Federal Register** 47,627 (November 19, 1985)

[12] Alan J. Auerbach, "Corporate Taxation in the United States," **Brookings Papers on Economic Activity** 2 (1983) : 451-505.

Reserve priced service operations should be set so as to reflect effective tax rates on new investment. Such a policy would be consistent with the goal of pricing in a manner that permits entry by private sector competitors.

Using Effective Marginal Tax Rates to Impute Taxes Imputed tax rates for Federal Reserve priced services could be calculated using a methodology similar to that employed in economic studies of effective corporate tax rates on U. S. industry.[13] To start, implicit user costs would have to be calculated for each type of asset. These user costs would be computed so as to reflect the present value of tax benefits, such as depreciation allowances and 'the investment tax credit where applicable. Total imputed financing and tax costs could then be determined by aggregating imputed earnings for each asset.

It should be noted that the procedure suggested above does not correspond to rate-setting practices employed by public utility commissions. Regulated utilities are permitted to recover actual tax liabilities incurred as a result of past tax laws. In competitive markets, however, prices are determined by prevailing opportunity costs. The cost of new investment does not depend on effective tax rates on capital purchased in the past, but on current tax laws. Rate-setting procedures that base prices on actual tax liabilities effectively protect shareholders of regulated firms from capital gains and losses resulting from changes in tax laws. Nonregulated firms, however, are not protected from such risks. The procedure outlined above would therefore be more consistent with economic theory.

Logical Consistency

The test for logical consistency attempts to determine whether a rate-setting procedure can be logically expected to attain its goals. The ultimate goals of Federal Reserve pricing are to permit private sector entry into the markets it serves and also to promote efficient resource allocation. Both of these goals are attained when the targeted rate of return to capital reflects the true cost of capital faced by private sector competitors. Therefore, the logical consistency of the Federal Reserve's rate-setting procedure can be judged by whether it can be expected to produce targeted rates of return that equal the true cost of capital on average.

The Problem of Circularity At present the Federal Reserve bases its targeted rate of return on the average historical book rate of return earned by a sample of firms it views as its principal competitors. Rates of return earned by these competitors are determined in part by the prices the Fed charges for its services, however. A recent congressional report on Federal Reserve pricing practices noted that this could lead to a potential circularity problem.[14] If targeted rates of return are set too low, as can happen when book rates of return are below market rates, correspondent bank earnings can be adversely affected by Federal Reserve pricing policy. To the extent that correspondent bank earnings are measurably affected by Fed pricing policy, subsequent targeted rates of return would be based on artificially depressed earnings that are themselves a product of the rate-setting procedure. In this case, as long as targeted rates continue to be based on book rates of return, the rate-setting procedure cannot logically be expected to target the true cost of capital.

It could be argued that the circularity problem is unimportant as a practical matter because correspondent banking services account for only a small share of revenues earned by bank holding companies. According to this argument, revenues earned from activities such as commercial lending, for example, are likely to be relatively more important than revenues from the sale of services such as check clearing (which is the principal area of competition between the Federal Reserve and commercial banks) in determining overall rates of return for the holding company sample.

This argument was acknowledged in the congressional report. That report, however, also noted that the argument calls into question the assumptions underlying the adoption of the bank holding company model. Use of the bank holding company model is predicated on the assumption that, because the largest bank holding companies are the Federal Reserve's principal competitors, the cost of capital to those firms should determine the targeted rate of return for priced services. But when a firm engages in a number of different activities its cost of capital for different investment projects will, as a general rule, differ because different projects do not carry the same risks. Thus, an estimate of the cost of capital based on overall rates of return earned by bank holding

[13] A review of these methods is contained in Alan J. Auerbach, "Taxation, Corporate Financial Policy and the Cost of Capital," **Journal of Economic Literature** 21 (September 1983) : 905-40.

[14] **The Role and Activities of the Federal Reserve System in the Nation's Check Clearing and Payments System,** Report of The Subcommittee on Domestic Monetary Policy of the Committee on Banking, Finance and Urban Affairs, 98 Cong. 2d sess., pp. 41-43.

companies might not reflect the cost of capital for payments services even if the bank holding company sample does include the Federal Reserve's major competitors. Implicitly, then, the bank holding company model assumes that the cost of capital for investment projects related to payments services is the same as the average cost of capital faced by large bank holding companies. This is a strong assumption, and one that is difficult to either prove or disprove. It is worth noting, however, that bank holding companies are not the Fed's only competitors. In the market for automated clearinghouse services, for example, a nonbanking firm has recently begun to compete with the Fed.

A Suggested Alternative Procedure Problems with circularity are not unique to Federal Reserve pricing. They are also encountered with rate-setting procedures commonly employed by public utility commissions. Indeed, the pricing methodology adopted by the Federal Reserve is based on such commonly used procedures. The problem of circularity is therefore a familiar one to regulatory economists.

As an alternative to the bank holding company model, the congressional report cited earlier suggested using the Capital Asset Pricing Model in conjunction with data on market rates of return for a broad-based sample of U. S. industry. The proposed methodology outlined in the report is one that has gained increasing acceptance among public utility commissions in recent years.[15]

Adoption of a broad-based 'sample of U. S. industry was suggested as a means of dealing with the potential problem of circularity. Firms included in this larger sample should ideally bear risks that are comparable to those facing suppliers of correspondent banking services. To some extent, the CAPM could be used to adjust for differences in financial risk across the sample.

Using market rates of return could help mitigate any potential problems with circularity because market forces cause equity prices to adjust until the expected return to equity and the cost of equity are equated. Thus, to the extent that Federal Reserve pricing policy does affect correspondent bank earnings, subsequent realized rates would not deviate systematically from expected rates as book rates of return would.

These suggestions appear to offer a means of improving the current procedure. However, the proposed methodology is not without its own shortcomings. First, the CAPM has itself been subject to criticism on theoretical grounds because it assumes that the covariance of returns with the market portfolio is the only factor determining the risk premium expected by shareholders. As noted earlier, Arbitrage Pricing Theory is not subject to the same criticisms.

Second, adoption of the method described above would also require the Fed to resolve a number of difficult problems not normally encountered in other types of rate-setting procedures. The weighted-average cost of capital depends not only on the cost of equity finance, but also on the cost of issuing debt and the overall financial structure. In determining allowable rates of return for privately owned public utilities, the firm's financial structure need not be assumed or imputed. The amount of outstanding debt, the interest rates paid on that debt, and the debt-equity ratio are all given.

In contrast, estimating the appropriate cost of equity finance for the Federal Reserve is only the first step in determining the overall imputed cost of capital. If bank holding companies are not used as a model of financial structure, then some other model must be adopted. A more appropriate model is not immediately evident, however. Finally, because the financial structure of banks tends to differ from that of other types of firms, it could prove difficult to select a sample of firms from other industries that bear comparable business and financial risks. For the present, these latter issues remain unresolved.

IV. COST ALLOCATION

As the nation's central bank, the Federal Reserve System bears responsibility for discharging a variety of tasks. Fed services are grouped into four general categories : (1) Monetary Policy, (2) Supervision and Regulation, (3) Treasury, and (4) Financial Institutions and the Public. Monetary policy can be characterized as a nonexcludable public good, and would therefore be difficult to price explicitly since everyone benefits whether they pay or not. Bank supervision has some attributes of a public good, although the Federal Reserve is the only federal bank regulatory agency that does not charge for examinations. Treasury, or fiscal agency functions, are not priced because the Federal Reserve routinely turns over all surplus revenues to the Treasury. Correspondent banking and payments services fall into the

[15] It is also the methodology that appears to be favored by regulatory economists. See, for example, Kolbe, Read, and Hall, **The Cost of Capital,** chap. 3.

fourth category. The Monetary Control Act requires these services to be priced.[16] Pricing is feasible for these services because they have the characteristics of private goods.

Because not all services are priced, costs attributable to priced services must be identified and separated from other costs. Sales of priced services vary among Reserve Banks, so individual cost recovery targets must be set for each Bank. Finally, separate cost recovery targets must be set for each individual priced service line.

The Private Sector Adjustment Factor

Operating expenses are allocated to different services using a cost accounting system known as PACS (Planning and Control System). PACS also determines the value of capital assets devoted to priced services. (See insert for more details.) Capital financing costs and other imputed private sector costs are distributed to the different priced service lines using a uniform mark-up over operating expenses known as the Private Sector Adjustment Factor (PSAF).

As a first step in calculating the PSAF, total capital financing costs are determined using (1) the estimated financial cost of capital from the bank holding company model, and (2) the value of the priced services asset base obtained from the PACS accounting system. If the variable r represents the imputed pre-tax cost of capital and K the value of the asset base, then total imputed capital and corporate income tax costs, denoted by the variable CC, are given by :

$$CC = rK.$$

Other PSAF adjustments include allowances for sales taxes, federal deposit insurance assessments, and a portion of expenses incurred by the staff of the Board of Governors. Strictly speaking, these imputed costs should be classified as operating expenses. However, the PSAF cost allocation procedure groups them together with imputed capital and income tax costs. For purposes of this discussion, therefore, the variable CC should be regarded as representing capital costs plus the other imputed private sector costs mentioned above.

[16] The fourth category also includes a number of services that are not priced. The basic service lines subject to the pricing requirements of the Monetary Control Act are: (1) currency and coin services, (2) check clearing and collection services, (3) wire transfer services, (4) automated clearinghouse services, (5) settlement services, (6) securities and safekeeping services, (7) float, and any new services the Federal Reserve offers.

Cost Accounting Methods

The Federal Reserve's Planning and Control System (PACS) was designed initially as a budget expense and control system, but was modified to serve as a cost accounting system capable of meeting the requirements of pricing. PACS performs three basic tasks. First, it identifies all direct expenses incurred as a result of separate activities. Second, it allocates overhead expenses to different service lines. Third, it allocates capital assets to different services so that imputed capital financing costs can be determined.

Identifying the direct expenses" incurred in producing different services is, at least in principle, a straightforward task, and one that PACS was originally designed to perform. Like other cost accounting systems, PACS allocates direct expenses, such as wages and salaries, to different services.

Allocating indirect, or overhead, expenses poses a more difficult problem. Examples of overhead activities include Bank administration, personnel administration (including recruiting and placement and wage and salary administration), and protection (security services). PACS uses estimates of the proportion of overhead expenses attributable to each activity to allocate overhead expenses. For example, costs associated with personnel administration are allocated according to the ratio of personnel employed by each service, while cost allocations for Bank administration are determined by the ratio of direct expenses incurred by different priced services. Expenses arising from security services, on the other hand, are allocated according to a survey of the percentage of manhours devoted to protection of valuables.

The priced services asset base is determined using a direct determination method that allocates all single purpose assets directly to the activity employing them. Some capital assets, termed joint-purpose assets, are used for a variety of different purposes. A good example of a joint purpose asset would be a Federal Reserve Bank building, which typically houses all activities performed by the Bank. Joint-purpose assets are allocated to different services in much the same way as overhead expenses ; that is, based on estimates of usage. Assets used in overhead activities are allocated to individual services based on overhead expense allocation ratios.

The PSAF procedure groups direct operating expenses together with overhead expenses measured and calculated by PACS. Let the variable OE represent total operating expenses, including noncapital overhead expenses, allocated to priced services. The PSAF mark-up is the ratio of imputed private-sector costs to all other operating expenses:

$$PSAF = \frac{CC}{OE}$$

Notice that, multiplying this ratio by total operating expenses, OE, would just recover total imputed costs.

In calculating the PSAF, aggregate cost data for all the Federal Reserve Banks and all priced services are used. The resulting mark-up is applied uniformly to all services offered by Reserve Banks to arrive at separate cost recovery targets. To see how the procedure works, let OE_{ij} denote total expenses allocated to activity i (where activity i represents a particular priced service) at bank j. Then, total private sector expenses imputed to that activity are determined by the product PSAF x OE_{ij}.

For services such as check clearing, for which prices may vary by region, separate cost recovery targets are determined for each Reserve Bank. Other services such as electronic funds transfer have prices set uniformly on a nationwide basis. Cost recovery targets for those services are determined on the basis of aggregate systemwide costs incurred in producing the service, calculated by summing service costs across all Reserve Banks.

Notice that the PSAF cost allocation procedure is not intended to recover "overhead" expenses in the sense that that term is usually understood. The Fed's accounting conventions group overhead expenses other than capital costs together with other routine operating expenses in the variable OE. In contrast, the overhead mark-ups used by private-sector firms typically include all indirect overhead expenses (such as the cost of personnel management services) together with capital financing costs in the numerator of the mark-up ratio. The PSAF ratio is often mistakenly interpreted as representing such a mark-up. It should be clear from the preceding discussion that this is not the case.

Allocation of Imputed Costs

Now consider the effects of this allocation procedure on individual cost recovery targets. Notice that the imputed cost allocation to service i at bank j can be equivalently stated as :

$$PSAF \times OE_{ij} = \left(\frac{OE_{ij}}{OE}\right) \times CC,$$

where :

$$\sum_i \sum_j \frac{OE_{ij}}{OE} = 1.$$

The ratio (OE_{ij}/OE) represents the share of the total direct expenses incurred by Reserve Bank j in providing some projected amount of service i. From the above expression it is evident that using the same systemwide PSAF to impute capital and tax costs to separate activities amounts to weighting total imputed costs by the ratio of expenses incurred in providing service i at bank j to expenses for the system as a whole. Consequently, those services that are relatively costly to provide in terms of noncapital expenditures are also allocated a relatively larger share of capital and other imputed private sector costs. Similarly, regional Reserve Banks having relatively high noncapital costs in relation to other Reserve Banks are required to bear a relatively larger share of imputed private sector costs. The resulting cost allocation may or may not accurately reflect true underlying costs.

V. EVALUATION OF THE PSAF COST ALLOCATION METHOD

Like the bank holding company model, the PSAF cost allocation method resembles rate-setting methods commonly used in public utility regulation. These methods are reviewed and evaluated below and the analysis is applied to the PSAF methodology.

Fully Distributed Cost Pricing Methods

Fully distributed cost pricing refers to a variety of average cost pricing methods. Under this type of pricing, total projected revenue requirements are fully distributed on a per-unit cost basis and prices are set so as to satisfy those requirements. Such pricing methods are commonly used in public utility rate-setting proceedings to allocate targeted capital cost recoveries and other joint production costs to different types of services.[17] The PSAF mark-up used by the Federal Reserve is an example of fully distributed cost pricing.

[17] For a more complete description of different fully distributed cost pricing methods used in public utility regulation, see Alfred E. Kahn, **The Economics of Regulation: Principles and Institutions,** vol. 1 (New York: John Wiley and Sons, Inc., 1970), pp. 150-58.

One reason for the widespread use of fully distributed cost pricing methods lies with their relative simplicity. A second reason for the popularity of these methods stems from the widespread perception that they allocate costs fairly. By definition, fully distributed cost pricing imposes equal mark-ups on all services. It thus avoids the appearance of discriminatory treatment of different classes of customers.

Evaluation of Fully Distributed Cost Pricing Methods

Prices perform the task of allocating resources in a market economy. Economists therefore evaluate different pricing methods according to whether resource allocations resulting from those methods are efficient. In addition to economic efficiency, policymakers are also concerned with the issue of equity. Discriminatory pricing policies are prohibited under existing antitrust laws. The analysis that follows evaluates fully distributed cost pricing methods according to the criteria of efficiency and equity.

Economic Efficiency As a general rule economic theory finds that efficient resource allocation is attained when prices are set so as to reflect underlying marginal costs. Marginal costs measure the opportunity cost of the resources used to produce different goods and services. Efficient resource allocation requires that the ratio of prices charged for different goods and services equal the corresponding ratio of marginal costs, or that prices be proportional to marginal costs. When these conditions are satisfied, prices charged for different goods and services reflect the true cost to society of producing those items. From an operational standpoint, then, different pricing methods can be evaluated using departures from marginal costs as a guide to losses in economic efficiency.[18]

A special case arises when production is subject to economies of scale. This is typically the case for public utilities. Certain services produced by the Fed also appear to be subject to economies of scale.[19] When scale economies exist, marginal costs are below average costs so that strict marginal cost pricing will not recover total costs. In this case, efficient resource allocation is attained by setting prices in inverse proportion to demand elasticities.[20] A second-best solution involves either two-part pricing (e.g., an access charge plus a per-unit service fee reflecting marginal costs), or setting prices proportional to marginal costs so that total costs can be recovered while leaving price ratios equal to ratios of marginal costs.

For firms that produce a single output the last method amounts to average cost pricing. When a firm produces more than one output, however, production may involve joint costs. Joint costs exist when the same productive inputs are used to produce more than one type of output; for example, Reserve Bank buildings in the case of the Fed. When production is subject to joint costs, marginal costs are determined according to causal responsibility. The marginal cost of a good or service is the cost that could be avoided if the last unit of output were not produced, holding production of all other outputs fixed.

Unfortunately, marginal costs may be difficult to determine when production relies on joint inputs. For this reason, fully distributed cost allocation methods are often used to allocate joint production costs. In general, fully distributed cost allocations differ from marginal costs. But because marginal costs can be difficult to measure, precise measures of efficiency losses resulting from the use of fully distributed cost allocation methods are difficult to determine. Indeed, the cost of implementing true marginal cost pricing can exceed the economic value of efficiency gains resulting from such a policy. Thus, total economic costs may be lower under fully distributed cost pricing than under marginal cost pricing. This could occur if, for example, departures of fully distributed costs from marginal costs are small while the added cost of implementing marginal cost pricing is large.

Arguments such as the one above are frequently made to justify the use of fully distributed cost pricing methods. Unless some attempt to measure marginal costs is made, however, there may be no way to judge whether these methods really are relatively efficient.

Equity Price discrimination occurs when price differentials do not reflect differences in the underlying cost of selling to different purchasers. By

[18] This is the approach taken by Kahn, **The Economics of Regulation,** in his analysis of fully distributed cost pricing methods.

[19] See David B. Humphrey, "Costs, Scale Economies, Competition, and the Product Mix in the U. S. Payments Mechanism," Staff Studies 115 (Board of Governors of the Federal Reserve System, 1982).

[20] For a more complete discussion of efficient pricing see William J. Baumol and David E. Bradford, "Optimal Departures from Marginal Cost Pricing," **American Economic Review** 60 (June 1970): 265-83.

definition, then, marginal cost pricing is not discriminatory.[21] As noted by Alfred Kahn, "It is fair, as a general rule, to impose costs on people when and to the extent that they impose costs on society."[22]

Antitrust laws generally permit firms to charge price differentials when those differentials are based on differences in cost. Marginal cost pricing is therefore permissible under those laws. In view of the above considerations, marginal costs can be used as a standard to evaluate the fairness of different pricing methods in cases where marginal cost pricing is feasible.

Although fully distributed cost pricing methods are generally viewed as being fair, economic theory would classify them as discriminatory to the extent that the resulting prices depart from marginal costs. Imposing equal mark-ups may appear to be fair, but it does not always insure that purchasers pay the true cost of the goods and services received. The perception that fully distributed cost pricing methods are equitable continues to enjoy widespread, if misguided, acceptance, however, and such pricing practices have not been found to violate antitrust laws.

An Evaluation of Federal Reserve Pricing Practices

The preceding discussion suggests that fully distributed cost pricing methods can produce outcomes that are less than ideal from the standpoint of economic theory. In the case of Fed pricing policy, however, the existence of competition provides an independent check of cost allocation practices and mitigates the distortionary effects of inappropriate pricing decisions when they occur.

Economic theory predicts that firms operating in purely competitive markets will price according to marginal costs. Under these conditions the issues of efficiency and equity are resolved by the market. In contrast, competition is restricted in regulated markets such as those served by public utilities so that regulatory agencies take the place of the market in determining prices. Rate-setting methods used by those agencies are shaped by the goals of efficiency and equity, but the definition of equitable pricing behind the adoption of those methods do not always agree with the economist's notion of that term.

Debate over appropriate standards of equity and efficiency that should guide Fed pricing policy is a less contentious issue because the Fed must compete with private sector suppliers. As long as aggregate imputed costs are estimated correctly, an inappropriate allocation of costs between different service lines would result in some services becoming relatively overpriced while others are underpriced. If that happened, the Fed would find it difficult to retain market share for those services that are relatively overpriced, thus making it difficult to continue indirectly subsidizing relatively underpriced services. Thus, the presence of competition makes it difficult for the Fed to adhere to a pricing policy that might otherwise result in inefficient resource allocation or unequitable treatment of certain customers.

Market-Sensitive Pricing In response to market forces and to minimize the distortionary effects of fully distributed cost pricing the Fed has instituted market-sensitive pricing for individual services within a service line. While overall cost recovery targets for broadly defined service lines, such as commercial check clearing and ACH, are partly determined by the PSAF mark-up, prices for individual services comprising those service lines are set in response to market forces. Market-sensitive pricing is efficient to the extent that the PSAF mark-up allocates total imputed capital costs to each service line appropriately.

A feasible alternative to the current practice of allocating costs using a uniform mark-up would be to set targeted cost recoveries based directly on capital assets allocated to each service line by the PACS accounting system, in effect creating a separate mark-up, or PSAF, for different service lines. The resulting cost allocation should more closely approximate true marginal costs.

Imputed Deposit Insurance Costs There is at least one other area, namely imputed deposit insurance expenses, where marginal cost pricing principles could be applied to Fed pricing. At present, these expenses are allocated together with imputed capital costs using the PSAF mark-up. Since they are determined by the level of clearing balances held with Reserve Banks, it would seem more appropriate to charge imputed deposit insurance costs against the profits earned on clearing balances. This would probably require a downward adjustment to the interest rate paid on clearing balances.

[21] For a more detailed discussion of price discrimination, see. F. M. Scherer, **Industrial Market Structure and Economic Performance** 2d ed. (Boston: Houghton Mifflin Company, 1980), chap. 21.

[22] Alfred E. Kahn, "The Road to More Intelligent Telephone Pricing," **Yale Journal of Regulation** 1 (1984): 146.

VI. SUMMARY AND CONCLUSIONS

Because the Federal Reserve is a nonprofit institution, its cost of capital is not determined in capital markets as is the case with purely private, profit-making firms. Nevertheless, the Monetary Control Act requires the Fed to earn a return to capital comparable to that earned by private firms. Consequently, the Fed is faced with the task of determining an appropriate rate of return to capital for its priced services.

A similar problem arises in connection with public utility regulation. While most utilities are privately owned, their return to capital is determined by regulatory fiat rather than by market forces. Given the similarity between public utility and Federal Reserve pricing, it should not be surprising that the Fed's pricing methodology is patterned after rate-setting methods developed for public utility regulation.

Rate-setting methods for regulated industries have received a great deal of attention from economists. Research on this topic has dealt with the problems of identifying appropriate operational goals and developing methods of evaluating different rate-setting procedures. Although problems encountered in public utility regulation are not identical in all respects to those connected with Federal Reserve pricing, some of the methods developed to analyze such rate-setting procedures can be used to evaluate Federal Reserve pricing methods. The analytical framework developed in this article represents a first step toward that goal.

MONETARY POLICY IN THE EARLY 1980s

*Robert L. Hetzel**

1. Introduction

On October 6, 1979, the Federal Reserve System changed its operating procedures in order to enhance its control of the money supply. The new procedures, which employed targets for nonborrowed reserves, remained in force until the fall of 1982. Though the Fed itself never characterized its policy as monetarist, it has been widely argued outside the Federal Reserve that the new procedures constituted a "monetarist" experiment. It has also been contended that the attempt by the Fed to control the money supply through reserve targeting was unsuccessful. For example, these views are expressed in the following excerpt from a newspaper article that recommended abandonment of the October 1979 operating procedures [Nordhaus (1982)]:

> The first, step [of a new economic policy] would be to bring down the curtain on the disastrous monetarist experiment of the last two years. The Federal Reserve should be directed to cease and desist its mechanical monetary targeting and to set monetary policy with an eye to inflation and unemployment. . . . At the same time, the Fed should overhaul its operating procedures. The techniques of emphasizing supply of bank reserves rather than interest rates since October 1979 has produced greater volatility of both interest rates and the money supply.

In this article, a chronological review is provided of the formulation of monetary policy and of the implementation of the new operating procedures during this period. Many economists have characterized monetary policy in this period in the way described above because of the coincidence of Fed policy actions generally dominated by a desire to reduce the rate of inflation and of Fed adoption of reserve, as opposed to funds rate, targeting. The review provided here, however, stresses the considerable continuity in the formulation of monetary policy before and after October 1979, rather than the occurrence of an isolated "monetarist" experiment. This continuity was provided by the practice of relaxing implementation of the new procedures when the behavior of money did not accord with the Fed's perception of the behavior of the economy.

The post-October 1979 operating procedures provided an interesting experiment in monetary control. They employed a combination of lagged reserve accounting and nonborrowed reserves targets. This combination requires that monetary control be effected through indirect control of the funds rate, rather than through a reserves-money multiplier relationship. In the review provided below, it is argued that this characteristic of indirect control of the funds rate at times contributed in practice to volatility in the money supply and in interest rates.

2. The Post-October 1979 Operating Procedures

Prior to October 1979, the Fed had specified "tolerance ranges" for intra-yearly growth of the money supply. These tolerance ranges, however, as emphasized at the time by the Fed, were more aptly described as benchmarks, rather than as targets. Deviations of projected money growth from these tolerance ranges triggered changes in the federal funds rate, but there was never any presumption that the resulting changes in the funds rate would be such as to bring actual money growth into line with the values specified in the tolerance range [Hetzel (1981)].[1] After October 1979, in contrast, there were intervals during which the funds rate was varied in a way intended to bring actual growth of the money supply into line with its intra-yearly targeted value.

This section presents an abbreviated overview of the operating procedures adopted on October 1979. It is assumed, however, that the reader is familiar with one of the more thorough descriptions available, for example, Hetzel (1982) or Goodfriend (1982).

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* The views in this article are solely those of the author and, it should be emphasized, do not necessarily reflect the views of the Federal Reserve Bank of Richmond or the Federal Reserve System.

[1] The FOMC emphasized that the tolerance ranges were not considered as targets for the money supply. "It was noted that, perhaps because of the manner in which the directive was worded, the 2-month ranges of tolerance for Ml and M2 were subject to misinterpretation as embodying the Committee's short-run targets for these aggregates, intended to be achieved by appropriate changes in the funds rate . . ." [Board of Governors (1978), FOMC meeting of June 20, 1978, p. 189]. The purpose of the 2-month ranges was to provide the Manager with an indicator for determining when changes in the funds rate were appropriate.

Because of lagged reserve accounting, the banking system's demand for reserves was essentially predetermined in a given reserve accounting period. Of this predetermined reserve demand, whatever the Desk did not supply through open market operations had to be borrowed by the banking system from the Fed. Given the pressure on commercial banks to find alternative sources of reserves exerted through the administration of the discount window, higher levels of borrowed reserves increased the excess of the funds rate over the discount rate. The funds rate, consequently, was determined as the sum of the discount rate plus an amount that varied positively with the level of borrowed reserves. (The relationship between the discount rate and the funds rate is shown in Figure 1. The relationship between borrowed reserves and the differential between the funds rate and the discount rate is shown in Figure 2). Ultimately, then, the new procedures worked through a leverage over the federal funds rate. The funds rate, which determined the cost of funds to banks, influenced bank portfolio adjustments and, as a by-product, bank liabilities and the money supply.

At Federal Open Market Committee meetings, the Fed specified an initial value for borrowed reserves (termed the initial borrowed reserves assumption). Given the intra-yearly target for M1 and, consequently, an implied path for total reserves, this initial value for borrowed reserves determined the target for nonborrowed reserves. Given the nonborrowed reserves target, the movement of total reserves associated with a miss of the M1 target produced a change in the level of borrowed reserves and in the funds rate. The change in the funds rate acted to offset misses of M1 from target. In addition to this kind of "automatic" change in the funds rate, the Desk could also effect "discretionary" changes by varying the nonborrowed reserves target.

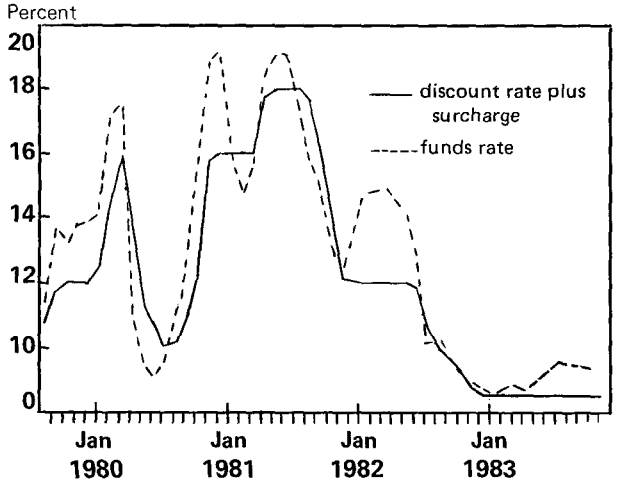
The remainder of this article presents a chronological review, from 1979 through 1982, of the implementation of this procedure. The purpose of this review is to attempt to elucidate the way in which the new procedures worked in practice.

3. The October 6, 1979 Actions

Starting in the spring of 1979, monetary policy became concerned with the threat of recession. "The Federal Open Market Committee received forecasts from its staff of a recession beginning July 1979 . . ." [Wallich (1980), p. 3]. Between February and July 1979, M1 grew at an annualized rate of 9.7 percent, but the funds rate was raised over this interval by only half a percentage point. By September, M1 and M2 were at the top of the intra-yearly ranges implied by their four-quarter target ranges.

Figure 1

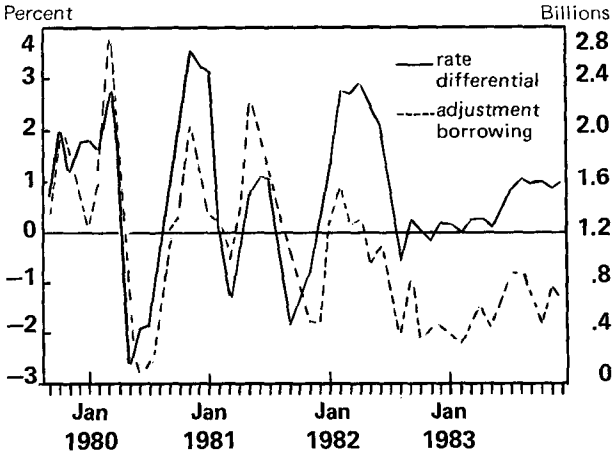
FUNDS RATE AND DISCOUNT RATE PLUS SURCHARGE



Note: From March 1980 through November 1981, in addition to the basic discount rate, a variable surcharge was applied to frequent borrowing by large banks from the discount window.

Figure 2

ADJUSTMENT BORROWING AND THE DIFFERENTIAL BETWEEN THE FUNDS RATE AND THE DISCOUNT RATE PLUS SURCHARGE



Note: Adjustment borrowing is borrowing at the discount window minus seasonal borrowing and extended credit.

The anticipated recession did not materialize. By September, inflation and depreciation of the dollar emerged as the primary concerns.

From the perspective of the Fed in October 1979, the overriding imperative for monetary policy was to assuage the inflationary psychology of the public that manifested itself in speculative activity in commodity and foreign exchange markets and threatened to spread to wage setting behavior.

> Inflation feeds in part on itself, so part of the job of returning to a more stable and more productive economy must, be to break the grip of inflationary expectations. We have recently seen clear evidence of the pervasive influence of inflation and inflationary expectations on the orderly functioning of financial and commodity markets and on the value of the dollar internationally. . . . [Volcker (1979b), pp. 888-9]

> . . . in the absence of firm action to deal with inflation and inflationary expectations, there was a clear risk that the runup in energy prices would work its way into wages and prices generally, thereby raising the nation's underlying inflation rate. [Volcker (1979c), p. 959]

The actions taken by the Fed on October 6, 1979, reflected its concern over inflationary psychology. The Fed felt it had to establish a credible anti-inflationary stance for monetary policy. New operating procedures that would allow the Fed to avoid overshooting its four-quarter target ranges for the monetary aggregates were considered a prerequisite for such a policy. ". . . it was clear by early fall that the growth in money and credit was threatening to exceed our own targets for the year and was nourishing inflationary expectations" [Volcker (1979c), p. 959].

In this situation, the Fed took actions to limit the extension of credit that, in its view, was financing speculative activity. Credit extension by banks was constrained by the imposition of marginal reserve requirements on their managed liabilities. "And we placed a special marginal reserve requirement of 8 percent on increases in managed liabilities of larger banks . . . because that source of funds . . . has financed much of the recent excessive buildup in bank credit" [Volcker (1979c), p. 960]. For the same reason, the increased variability of the funds rate under the new operating procedures was considered important. ". . . in the then existing market circumstances, perceptions (right or wrong) that changes in money market rates would be limited seemed to be encouraging banks and other lending institutions to aggressively market credit" [Volcker (1980b), p. 25]. Finally, the Fed urged banks not to extend credit for speculative purposes. "The Board of Governors has particularly stressed its own concern that, in a time of limited resources, banks should take care to avoid financing essentially speculative activity in commodity, gold and foreign exchange markets" [Volcker (1979a), p. 4].

On the basis of interviews with four governors and with Board staff, Woolley (1984, chap. 5) observes that, in fall 1979, effective money supply targeting appeared to offer solutions to the Fed's immediate problems. First, it was recognized that a credible anti-inflationary stance would require a significant rise in interest rates, but there was uncertainty over the magnitude of the rise required. A way of resolving this problem was to allow the funds rate to rise by whatever amount was necessary to prevent an overshoot of the four-quarter target range for M1. Second, the new procedures allowed full use of the language of monetary control in communicating to the public the need to raise rates. This latter point is made in the following quotations from Fed economists:

> By clearly communicating to the public the Federal Reserve's objectives for monetary policy, a monetary aggregates targeting procedure enables private decision-makers to better plan their activities and to make price decisions that are more harmonious with noninflationary growth in money and credit. [Axilrod (1981) p. 16]

> . . . the use of money stock targets in the context of winding down excessive monetary growth over time provides a means of communicating the objectives of policy with the rest of the government and with the public. . . . It should be noted that the possibility of defining an anti-inflationary strategy in terms of a long-term path for intermediate money growth rate targets, with its attendant advantages for internal and external communication, apparently has no analog in interest rate targets. There is seemingly no satisfactory way to state a long-term anti-inflation strategy in terms of nominal or real interest rates as can be done in the case of money growth targets. [Davis (1981), pp. 19-20]

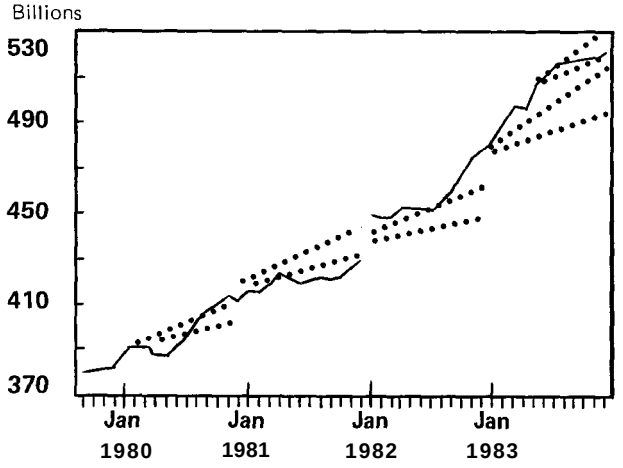
In these circumstances, for the first time, the Fed began to give the Desk meaningful targets for the money supply. (Prior to October 1979, the FOMC specified "tolerance ranges," rather than targets, for growth of the monetary aggregates. As discussed in Section 2, these tolerance ranges were not intended to be targets.) Beginning in October 1979, it replaced its tolerance ranges for money growth with actual intra-yearly targets derived from the four-quarter targets. It is also important to note that the Humphrey-Hawkins legislation, which took effect in 1979, required that the four-quarter target ranges for growth of money be applied solely to a fourth-quarter

base, rather than to a moving quarterly base as had been the prior practice. In this way, the phenomenon of base drift was eliminated over the calendar year. [Base drift seriously weakens the effectiveness of monetary targeting through the incorporation of misses of money from prior targets into new targets. See Broaddus and Goodfriend (1984).]

Initially, the new procedures appeared to work. The first significant deviation of M1 from its intra-yearly target occurred toward the middle of February 1980 when it became clear that M1 was growing in excess of its target. (See Figure 3.) The Desk responded by lowering the target for nonborrowed reserves modestly in late February and significantly in early March. The Board raised the discount rate from 12 to 13 percent effective February 15. By the March 18 FOMC meeting, M1 was back on target. This experience was one of the two times in the post-October 1979 period when the Desk responded to a miss of the M1 target by altering its nonborrowed reserves target promptly upon appearance of the M1 target miss. (There were a number of occasions when the target for nonborrowed reserves was changed, but only after it had become obvious that the change in borrowed reserves associated with the initial miss of the M1 target had failed to offset the miss.) [2]

Figure 3

M1 AND FOUR-QUARTER TARGET RANGES



Note: In order to display the data available contemporaneously, M1 is taken from the first Board of Governors statistical release H.6 showing complete monthly figures for a given year. In 1980, M1-B is used. In 1981, shift-adjusted M1-B is used. This series adjusts other checkable deposits for shifts from nondemand deposit sources. The discontinuity after 1981 arises from the discontinuance of the shift adjustment. After October 1982, the target range for M1 was replaced by a "monitoring" range. The dual ranges for M1 in 1983 reflect the rebasing of the M1 monitoring range in July 1983.

4. Credit Controls

The Special Credit Restraint Program (SCRP) was announced March 14, 1980. According to the Board press release, the SCRP represented "further actions to reinforce the effectiveness of the measures announced in October of 1979" [Board 1980b], The Fed valued the aspects of the SCRP that allowed it to restrict bank lending with the intention of reducing speculative credit extension. "Some parts (of the SCRP) were quite acceptable to us in terms of what we call voluntary restraints on banks" [Volcker (1983d), p. 48]. Specifically, banks were "informally" required to hold loan growth to within 6 to 9 percent. Also, for large banks, the reserve requirement imposed on managed liabilities exceeding a base level was increased to 10 percent. A surcharge on the discount rate of three percentage points was applied to borrowing by large banks. Extension of consumer credit was discouraged by a special deposit requirement of 15 percent on increases in covered types of credit, and increases in assets of money market mutual funds were subject to a reserve requirement of 15 percent.

As stated in the initial Board press release, the SCRP was intended to prevent "use of available credit resources to support essentially speculative uses of funds." The sharp effect of this program on curtailing credit extension by banks, however, frustrated the monetary control aspects of the Fed's October 1979 actions [Hetzel (1982)]. Just prior to the introduction of the SCRP, M1 was on target. The SCRP severely crimped the extension of bank credit and, in the process, pushed M1 well below its target range (Figure 3). The strongly depressing effects of the SCRP on credit extension were unforeseen, and it was undoubtedly not anticipated that the new operating procedures and the SCRP would work at cross purposes. The new operating procedures caused the drop in M1 to produce a large reduction in the funds rate. This reduction mitigated the depressing effect of the SCRP on the economy.

[2] Discussion of changes in the target for nonborrowed reserves is contained in the annual "Monetary Policy and Open Market Operations" reports from the New York Desk that are published in the Federal Reserve Bank of New York **Quarterly Review.**

5. Money Supply Targeting in 1980

As suggested in the introduction, the new procedures were allowed to exert their full effect on the funds rate only when the Fed believed that the behavior of the money supply was reflecting the behavior of the economy. As shown in Figure 3, 1980 contained an incipient monetary acceleration that peaked in February and a more sustained acceleration that dominated the second half of the year. In the latter case, M1 exceeded its intra-yearly targets from the August 12 through the December 19 FOMC meetings. In the first instance, but not the second, the new procedures were applied rigorously from the very beginning of the monetary acceleration. Only in the first instance, did the Fed consider, at the start of the monetary acceleration, that the money supply was reflecting the behavior of the economy.

In the first quarter of 1980, incoming data indicated considerable strength in the real sector. This strength was reflected in the strength in M1; therefore, the Fed was willing to allow the strength in M1 to raise the funds rate. Incoming data in the second and third quarters indicated weakness in the economy, and it was generally accepted by midsummer that a major recession was under way. The strength of Ml in the summer did not accord with the current, widespread perception of weakness in the economy; therefore, the new procedures were not implemented in a way that would produce a significant rise in the funds rate. From the July through the October FOMC meeting, the intra-yearly target for M1 was raised from the bottom to the top of the four-quarter target range. The discount rate was raised a percentage point on September 26, but other increases in the discount rate and significant reductions in the target for nonborrowed reserves were postponed until November [Hetzel (1982), pp. 247-8]. As the fall progressed, it became clear that the recession of late spring and summer had only been a temporary reaction to the SCRP and that the economy was growing strongly. As it became clear that the strength in M1 reflected strength in the economy, the Fed became willing to allow the new procedures to increase the funds rate sharply.

6. The Working of the New Procedures

Before discussing the behavior of interest rates and money in the last half of 1980, it is necessary to explain several aspects of the October 1979 operating procedures and the environment in which they were employed. As noted in Section 2, the new procedures continued to effect monetary control through the funds rate, rather than through a reserves-money multiplier relationship. The level of the funds rate emerged as the sum of the discount rate and a differential that varied positively with the level of borrowed reserves. Given the predetermined demand for reserves under lagged reserve accounting, borrowed reserves were determined as a consequence of the target for nonborrowed reserves.

Monetary control under the new procedures was rendered difficult through the lack of a reliable model for deriving the funds rate from the money supply target.[3] There also was no reliable model for deriving the level of borrowed reserves that would produce the desired differential between the funds rate and the discount rate.[4] Because the level of borrowed reserves determined the funds rate (given the discount rate), it was the key variable in the new monetary control procedure.

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[3] The difficulty of associating a value of the funds rate with the money supply target was clearly recognized at the time in relation to the former operating procedures.

> . . . the operational guide for day-to-day open market operations before October [1979] had typically been the federal funds rate. However, the translation of money stock objectives into day-to-day management of this rate presupposes a stable and predictable relationship between the public's demand for cash balances and short-term market rates of interest. This relationship becomes particularly difficult to appraise in an environment of rapid price increases, changing inflationary expectations, and financial innovations. [Volcker (1980a), p. 139]

[4] ". . . the federal funds rate, [which] the market focuses on as a policy indicator, can vary widely for a given level of borrowing. Changes in the federal funds rate appear to be strongly influenced not only by the borrowing level itself but also by past borrowing experience and by market expectations of future rate developments" [Levin and Meek, p. 28]. Goodfriend (1983) formalizes this statement. Prediction of the relationship between borrowed reserves and the differential between the discount rate and the funds rate was also rendered difficult by the periodic use of surcharges over the discount rate that were applied to borrowing by large banks.

The FOMC specified the value of borrowed reserves that would begin the interval between FOMC meetings (termed the initial assumption for borrowing). The **Record of Policy Actions** omits discussion of how this variable was set. According to the initial description by the Fed of the new procedures, however, a simple rule of thumb was employed. "The amount of nonborrowed reserves-that is total reserves less member bank borrowing-is obtained by initially assuming a level of borrowing near that prevailing in the most recent period" [Board (1980a)]. "Typically, the Committee has chosen levels [of initial borrowed reserves] close to the recently prevailing average . . ." ["Monetary Policy . . ." (1980), p. 60]. The annual "Monetary Policy and Open Market Operations" reviews published by the Desk in the New York **Quarterly Review** provide lists of the initial values of borrowed reserves set by the FOMC. Comparison of these values with values of borrowed reserves observed for the statement week in which FOMC meetings were held indicates that this rule of thumb continued to be employed. (The initial borrowed reserves assumption was adjusted for erratic movements in the relationship associating borrowed reserves with the differential be-

> Experience has demonstrated that it is difficult to determine in advance the appropriate level of borrowing to be employed in constructing the nonborrowed reserve path consistent with the short-run money supply target. This level of borrowing would depend on a projection of market interest rates consistent with the money supply target path and knowledge of depository institutions' willingness to borrow, given the spread between market rates and the discount rate, and could differ significantly from borrowing levels based on or ranging around recent experience. . . . projections of borrowing demand from interest rate forecasts and past bank behavior are subject to a considerable degree of error. [Axilrod (1981), p. 24]

> . . . along with the demand for money, the borrowings function remains one of the more troublesome specifications in the monthly model. [Tinsley et al (1982), p. 849]

In the absence of a model that could be employed to determine reliably the value of borrowed reserves (and the funds rate) that would produce the targeted value of the money supply, the level of borrowed reserves (and the funds rate) was set through the feedback induced by misses of the M1 target.

The character of the feedback mechanism running from a miss of the M1 target to changes in the funds rate was shaped to a significant degree by the behavior over time of the relation running from borrowed reserves to the differential between the funds rate and the discount rate. At the start of a monetary acceleration, bank use of the discount window is negligible. Banks are allowed to use the discount window without the administrative pressure that causes them to look to the funds market for reserves and thus force up the funds rate and other market rates. As a monetary acceleration persists, banks are forced to use the discount window over an extended period and become subject to administrative pressure. Consequently, the passage of time causes a given level of borrowed reserves to produce a higher differential between the funds rate and the discount rate.[5]

It must also be noted that the new procedures altered the significance of discount rate changes for monetary control. Before October 1979, when the Desk targeted the funds rate directly, changes in the discount rate could not affect the level of the funds rate. After October 1979, the Desk targeted nonborrowed reserves, while the demand for total reserves was essentially predetermined because of lagged reserve accounting. Consequently, the amount of reserves the banking system had to borrow in a reserve accounting period was given. Changes in the discount rate altered the marginal cost of obtaining this given amount of reserves; therefore, changes in the discount rate were passed on directly to the funds rate (provided the funds rate was above the discount rate so that the procedures were operable).

After October 1979, the Fed continued to employ changes in the discount rate to communicate policy intentions to financial markets. During the 1970s, the discount rate served as a signal of Fed intentions with respect to the funds rate. A rise, say, in the funds rate preceded by a rise in the discount rate signaled to the market that the increase in the funds rate would be long lived. In the fall of 1980, as the differential between the funds rate and discount rate widened, the market interpreted the Fed's willingness to raise the discount rate as a test of Fed willingness to allow interest rates to rise to whatever level was necessary in order to achieve monetary control.[6]

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tween the funds rate and the discount rate. In particular, when this differential would change, for a given level of borrowed reserves, in a way unrelated to the current miss of the total reserves path, the initial assumption for borrowed reserves was adjusted in order to eliminate the corresponding erratic movement in the funds rate.)

[5] In discussing the monetary acceleration of the last half of 1980, Levin and Meek argue that the temporal pattern relating borrowed reserves to the funds rate just described was reinforced by the way in which the financial markets formed their expectations. In particular, a moderate initial rise in the funds rate in response to a money supply overshoot led to larger rises later on.

> The third, and in some respects, most interesting episode began in August 1980, when a surge in money supply led to an immediate rise in discount window borrowing as the demand for total reserves exceeded the NBR path. However, since member banks had been essentially out of the window for some months. upward pressure on the federal funds rate was modest. . . . Market participants took the moderate rise in the federal funds rate as an inadequate response to the continued rapid expansion of the money supply after August's 19.3 percent annual rate of growth in M-1A. . . . The market was disappointed that the federal 'funds rate did not rise more vigorously. Talk that the Federal Reserve was not following through on its monetary objectives probably contributed to the widespread resurgence of inflationary objectives. . . . The fact that rapid money growth threatened achievement of the FOMC's 1980 objectives fed expectations that rates would move higher. The markets quickly translated these expectations into higher rates in a self-reinforcing process. [Levin and Meek (1981), pp. 31-3]

[6] Levin and Meek commented:

> Participants [in financial markets] repeatedly talked up the likelihood of discount rate increases as the federal funds rate rose further above the discount rate-apparently on the theory that catch-up increases were needed under the flexibility principle specified in the announcement of the new strategy in October 1979. This interpretation became a part of the market's assessment of Federal Reserve dedication to monetary restraint. The rise in the spread was taken as indicating a further need for discount rate change rather than a measure of the pressure of banks' efforts to avoid recourse to the window. [Levin and Meek (1981), pp. 33-4]

A final point, the significance of which is brought out in the following section, concerns the volatility of inflationary expectations in the financial markets during this period. This volatility, it is argued below, may have interacted with the implementation of the new procedures in a way that caused monetary accelerations and decelerations to possess some self-reinforcing dynamics [Hetzel (1982)]. The monetary acceleration in the last half of 1980 appeared to have produced uncertainty in the bond market over the course of long-term rates. Sellers and buyers of bonds left the long-term markets for short-term markets. The sellers increased their demand for bank credit. The buyers only partly turned to the market for the nonmonetary liabilities of banks. The increased demand for bank credit was, therefore, only partly matched by an increased demand for the nonmonetary liabilities of banks. The result was to increase demand deposits and M1 and to reinforce the monetary acceleration in progress. In addition, reintermediation on the asset side of bank balance sheets became important. Market rates rose as the monetary acceleration progressed in the last half of 1980. Inertia in the prime rate caused it to lag market rates. As the customary positive differential between the prime rate and the paper rate practically disappeared, businesses shifted out of the paper market into the market for bank credit. The increase in the demand for bank credit added to deposit creation and reinforced the existing monetary acceleration.

To summarize, to the usual difficulties of trying to effect monetary control through the funds rate, the new procedures added several additional uncertainties surrounding the relationship between the level of borrowing and the funds rate. Moreover, the discount rate assumed a new and more significant role under the new procedures. With the background in this section, it is now possible to discuss the monetary acceleration that occurred in the last half of 1980.

7. Monetary Acceleration in the Last Half of 1980

As shown in Figure 3, the monetary acceleration of the last half of 1980 carried M1 from well below the four-quarter target cone to somewhat above it by year-end. This monetary acceleration can be understood by putting together the separate pieces discussed above. In the late spring, the new operating procedures pushed the funds rate sharply lower in response to the monetary deceleration produced by the SCRP. The end of this program allowed the economy to revive and caused a resurgence of credit demands. The funds rate was at too low a level to prevent a monetary acceleration. Borrowed reserves rose in response to the overshoot of the M1 target in August. Because banks had been out of the window, however, this increase in borrowed reserves initially produced only a small increase in the funds rate. In an environment of concern over the recession, however, the Fed did not make discretionary changes in its operating variables that would have raised the funds rate ["Monetary Policy . . ." (1981), p. 73 and Levin and Meek (1981), p. 35].

Given the persistence of the overshoot of the M1 target, the characteristics of the operating procedures described above acted to increase the funds rate. First, the target for borrowed reserves was raised by the M1 overshoot. Second, the administration of the discount window caused given levels of borrowed reserves to produce over time a higher differential between the funds rate and the discount rate. Third, as the monetary acceleration persisted, the Fed became concerned that the bond market would perceive monetary policy as having become inflationary. For this reason, as the differential between the funds rate and the discount rate widened, it raised the discount rate, even though the immediate effect of such an action was to raise the funds rate and to leave this differential unaffected. Finally, as the monetary acceleration persisted, the target for nonborrowed reserves was lowered.

All these factors combined to force a sharp increase in the funds rate toward year-end. The funds rate rose about three percentage points in each of the months November and December, reaching a peak of 20 percent early in January 1981. The new procedures raised the funds rate in light of the monetary overshoot. The subsequent monetary deceleration, however, indicates that this process was carried too far. An overshooting of the funds rate occurred and a monetary deceleration ensued. This conclusion could only be derived after the fact, however, in the absence of a reliable means of associating targets for the money supply with associated values of the funds rate.

8. Monetary Deceleration in 1981

As background, it should be noted that the transactions measure of the money supply targeted in 1981 was called shift-adjusted M1-B. M1 comprises all

checkable deposits. The introduction nationwide in 1981 of the new interest-bearing checkable deposits, NOW and ATS accounts, imparted a one-time fall to the income velocity of M1 to the extent that these new checkable deposits were drawn from nonmonetary sources. Institutional arrangements encouraged in particular the relabeling of savings accounts as NOWs due to the existence of the same Regulation Q ceiling on savings and NOW accounts, even though the latter offered transactions services not offered by the former. Shift-adjusted M1 represented an attempt to construct a money series comparable to the old M1 series by removing increments to NOW and ATS accounts originating from nonmonetary sources such as savings deposits. Considerable effort on the part of the Board staff went into the construction of the shift-adjusted M1 series [See Bennett (1982) and Simpson (1981)]. The shift-adjusted M1 series exhibited a sharp deceleration in 1981. Using fourth-quarter to fourth-quarter figures, Ml grew at about 8.3 percent in 1977 and 1978. In 1979 and 1980, M1 grew at 7.5 percent and 7.3 percent, respectively. In 1981, the growth rate of shift-adjusted M1 fell to only 2.3 percent.

The economic recovery begun in the second half of 1980 extended into 1981. Real GNP grew by 8.6 percent in 1981Q1. (Subsequently, the business cycle peak was dated as July 1981.) The irregular slowing of the rate of growth of various price indices provided mixed evidence on whether inflation was slowing. The implicit GNP deflator rose by 8.9 percent from 1980Q4 to 1981Q4, a slowing of only a percentage point from the previous year. The producer price index rose at a 12 percent rate through April, but rose more slowly thereafter. The rise in the CPI moderated in the first and second quarters, but rose more strongly in the third quarter. In this economic environment, the Fed continued to be concerned about displaying a firm anti-inflationary posture. It was hoped that such a posture would exercise a restraining effect on wage settlements in 1982.

> The stubbornness of our inflation in large part reflects the adaptation of our economic and social institutions to persistently rising prices. The process is embedded in a whole pattern of economic, social, and political behavior that tends to sustain and intensify its own momentum. We see the process at work in contracts that extend over a period of time: in the pattern of three-year wage bargaining, building in past or anticipated rates of inflation into future cost. . . . The most critical area-inevitably, because it accounts for some two-thirds of all costs-is the trend of wages and salaries. [Volcker (1981b), pp, 10-11]

> . . . a crucially important round of union wage bargaining begins next January, potentially setting a pattern for several years ahead. That is one reason why we need to be clear and convincing in specifying our monetary and fiscal policy intentions and their implications for the economic and inflation environment. [Volcker (1981a), p. 617]

The monetary deceleration that began toward the end of 1980 caused shift-adjusted M1 to remain below its four-quarter target cone in the first quarter of 1981 (Figure 3). As a consequence, the new operating procedures pushed the funds rate down to 14.7 percent in March. M1 grew strongly in April, but still remained only at the lower boundary of the four-quarter target cone (Figure 3). Nevertheless, in early May the Board raised the discount rate and the surcharge on the basic discount rate, placing the surcharge rate at 18 percent (Figure 1). The Desk also reduced "substantially" the target for nonborrowed reserves ["Monetary Policy . . ." (1982), p. 47]. By May, the funds rate had been pushed back up to 18.5 percent.

At the May 18 meeting, the FOMC emphasized its concern that monetary policy appear firmly anti-inflationary.

> The indications of some slowing of the rise in the consumer price index did not appear to reflect as yet any clear relaxation of underlying inflationary pressures, and emphasis was placed on the importance of conveying a clear sense of restraint at a critical time with respect to inflation and inflationary expectations. [Board of Governors (1981), FOMC meeting held on May 18, 1981, p. 111]

In order to prevent weakness in M1 from lowering the funds rate, the FOMC adopted an open-ended directive with respect to the extent that growth in shift-adjusted Ml would decline. ". . . the Committee decided to seek behavior of reserve aggregates associated with growth of M1-B from April to June of 3 percent or lower. . . ." [Board of Governors (1981), FOMC meeting held on May 18, 1981, p. 112]. When M1 fell after the May FOMC meeting, the path for total reserves derived from the M1 target was reduced in line with reductions in actual total reserves in order to keep borrowed reserves and the funds rate from falling. In effect, the M1 target was lowered in line with the fall in actual M1.

Because of the wording of the directive specifying that M1 growth lower than 3 percent was acceptable, the decline of M1 in May and June was not allowed to affect the funds rate. The emphasis was placed on the behavior of M2, which was growing strongly. It was argued that the public's demand function for Ml had shifted leftward due to the growth of money

market funds that were serving as transactions balances and that are included in M2, but not M1.[7] "You may recall that last year [1981] M1 grew slowly. . . . We believe that this was a reflection of financial innovations including prominently the rapid growth of money market funds, which to some limited extent serve the function of transactions balances" [Volcker (1982c), p. 10].

The Desk stopped the effective lowering of the M1 target in line with the actual value of M1 in the last part of June; therefore, the weakness in M1 caused borrowed reserves to fall in July. The normal effect of this fall in producing a lower funds rate was offset, however, probably due to the characteristic of discount window administration whereby extended periods of borrowing increase the pressure on banks to turn to the funds market. In June and July the funds rate was at 19 percent, and in August it was almost 18 percent. Only in September did the fall in borrowed reserves depress the funds rate significantly. By early October, the shortfall of total reserves from path had reached the unprecedented level of $370 million ["Monetary Policy . . ." (1982), p. 51]. The first significant discretionary action taken in response to this shortfall was the one percentage point reduction in the discount rate effective November 2. Shift-adjusted M1 remained well below its four-quarter target cone throughout most of 1981. Throughout 1981, the implementation of the new procedures was influenced by the desire of the Fed to convey to the public its firm anti-inflationary resolve. ". . . a decline in short-term rates could exacerbate inflationary expectations and abort a desirable downtrend in bond yields and mortgage interest rates" [Board of Governors (1981), FOMC meeting held on November 17, 1981, p. 138].

9. Abandonment of the New Procedures

Early 1982 marks a transitional period during which the Fed became increasingly concerned with recession. Real GNP had remained essentially unchanged in the second and third quarters and fell in the fourth quarter of 1981, while by year-end inflation had clearly moderated. Consequently, the perception of the economy's most pressing problem began to change.

> Now we can see clear signs of progress on the inflation front. . . . we are also seeing signs of potentially more lasting changes in attitudes of business and labor toward pricing, wage bargaining, and productivity. . . . I believe the pattern is likely to spread, "building in" lower rates of increase in nominal wages and prices over time. And as the inflationary and cost pressures ease, the economy can resume a healthy pattern of growth. . . . [Volcker (1982b), pp. 167-8]

The Fed also continued to be concerned in early 1982 about the bond market. In the last several months of 1981, the federal deficit projected for fiscal year 1982 had risen from about $40 to $110 billion. For fiscal year 1984, projections of a balanced budget had given way to projections of a deficit of $150 billion. In this environment, the Fed remained concerned that any easing of monetary policy would exacerbate the inflationary anticipations of participants in the bond market.

The rate of growth of M1 rose in November and December of 1981 and surged in January 1982 to an annual rate of 21.5 percent. The January surge carried M1 above the level of the year-end lower boundary of the four-quarter target cone (Figure 3). The Fed reacted to this bulge in M1 in a way that reflected a compromise of conflicting concerns over recession and the inflationary expectations of financial markets. It retained the October 1979 operating procedures, but effectively raised the M1 target cone used for purposes of setting intra-yearly M1 targets. It retained the four-quarter M1 target cone for 1982 that employed as its base the realized 198lQ4 value of M1. It added, however, for purposes of policy discussions, a four-quarter M1 target cone for 1982 that employed as its base the 1981Q4 midpoint of the 1981 four-quarter target cone for M1 [Volcker (1982a), p. 17]. The result was a moderated increase in the funds rate. In 1981Q2, M1 had risen $12 billion while the funds rate increased 550 basis points, and the surcharge-adjusted discount rate was raised 300 basis points. In 1982Q1, M1 rose $10 billion while the funds rate increased 235 basis points, and the discount rate was not changed.

The primary concern of policy since October 1979 had been to convey a firm anti-inflationary stance in order to assuage the inflationary psychology of the public.

[7] The Record of Policy Actions states:

> It was also suggested that the weakness in growth of adjusted M-1B in the early months of the year might be a misleading indicator of the behavior of transaction balances, mainly because of the rapid growth of money market mutual funds; some part of the large flows into those funds might also be regarded as transaction balances. . . . In evaluating the behavior of the aggregates, it was agreed that greater weight than before would be given to the behavior of M-2. [Board of Governors (1981), FOMC Meeting of March 31, 1981, pp. 102-3]

> Progress toward disinflation at first was slow-almost invisible. . . . for a long while there was little room for modifying policy in response to domestic or international concerns. The danger was that the wrong "signals" would only increase the risk that the whole process of restoring stability--domestically or internationally--would be longer delayed or even aborted. [Volcker (1983c), p. 3]

In response to the moderation of inflation and the continuation of recession, economic recovery became a primary concern of monetary policy in 1982. A key assumption behind the design of the post-October 1979 operating procedures was the desirability of achieving intra-yearly M1 targets. In an environment in which a concern for inflation and the inflationary expectations of the public were no longer dominant and in which the predictability of the relationship between M1 and nominal GNP appeared to be diminishing, the desirability of attaining intra-yearly M1 targets was increasingly questioned.

> . . . we need . . . to be conscious of the fact that the world as it is requires elements of judgment, interpretation, and flexibility in judging developments in money and credit and in setting appropriate targets. . . . we cannot always assume a rigid relationship between money and the economy that, may not exist over a cycle or over longer periods of time, especially when technology, interest rates, and expectations are changing. . . . we must . . . take into account a wide range of financial and nonfinancial information when assessing whether the growth of the aggregates is consistent with the policy intentions of the Federal Reserve. The hard truth is that there inevitably is a critical need for judgment in the conduct of monetary policy. [Volcker (1982d), pp. 406-7]

Early in July, the Fed was concerned about the liquidity of the CD market in the aftermath of the Penn Square Bank failure. With the benefit of hindsight, however, it now appears that, within the context of the general concern over the economy described above, the primary immediate catalyst to the phasing out of the post-October 1979 operating procedures may have been a concern over the international debt situation. The sharp appreciation of the dollar in 1982 as well as the continued high level of market rates precipitated the situation in which numerous countries neared default on their external debt. The *Record of Policy Actions* of the FOMC indicates that the Fed began negotiating with the Bank of Mexico in June to furnish reserves under the existing swap arrangement [Board (1982a), p. 120]. Apparently, such negotiations were accompanied by the fear that defaults by large debtor nations would threaten the world financial system.

> . . . we have to evaluate the significance of developments abroad as well as at home, as reflected in trade accounts and the exchange rate, and of strains in the financial structure itself. [Volcker (1982f), p. 747]

> . . . the potential for an international financial disturbance impairing the functioning of our domestic financial markets at a critical point in our recovery is real. [Volcker (1983b), p. 170]

Coping with the international debt situation appeared to require a substantial reduction in the level of interest rates in the United States for a variety of reasons. First, because much of the debt of third-world countries in particular was of short maturity, a lower interest rate would reduce the burden of interest payments as debt was rolled over. Second, because this debt was denominated in dollars, a lower rate of interest in the United States would facilitate repayment by limiting the contemporaneous appreciation of the dollar. Third, a lower rate of interest in the United States would spur the U. S. economy and in the process increase the exports of debtor nations and their supply of foreign exchange. Finally, a lower rate of interest in the United States would allow central banks of other industrialized countries to lower their bank rates. The resulting stimulus to their economies would increase their imports from debtor countries. ". . . an environment of sustained recovery and expansion in the industrialized world is critically important" [Volcker (1983a), p. 82].

The usefulness of the new procedures was seriously questioned beginning in July.

> Moreover--and I would emphasize this--growth somewhat above the targeted ranges would be tolerated for a time in circumstances in which it appeared that precautionary or liquidity motivations, during a period of economic uncertainty and turbulence, were leading to stronger-than-anticipated demands for money. We will look to a variety of factors in reaching that judgment, including such technical factors as the behavior of different components in the money supply, the growth of credit, the behavior of banking and financial markets, and more broadly, the behavior of velocity and interest rates. I believe it is timely for me to add that, in these circumstances, the Federal Reserve should not be expected to respond, and does not plan to respond, strongly to various bulges--or for that matter "valleys"--in monetary growth that seem likely to be temporary. [Volcker (1982e), p. 491]

Beginning in the middle of July, the funds rate was lowered significantly through reductions in the discount rate and increases in the target for nonborrowed reserves. From the end of June to the end of August, the funds rate fell from about 15 percent to about 9 percent. (At the time, M1 was just within

the four-quarter target cone. M2 and M3 were both above their target ranges.) The October 1979 procedures were revived for the last time in September when the resurgence of M1 growth was allowed to increase the target for borrowed reserves and the funds rate rose a percentage point. The increase in the funds rate was brought to an end by a large increase in the target for nonborrowed reserves.[8] At its meeting on October 5, the FOMC formally dropped M1 as a target of policy. It was argued that M1 for the time being was no longer a useful target because the maturing of All Savers Certificates in October and the introduction of money market deposit accounts in December would render its behavior difficult to interpret. Formally, M2 and M3 were retained as targets, but the *Record of Policy Actions* for the October 5 FOMC meeting indicates that continued growth above their target ranges would not affect the funds rate.

Higher rates of growth of Ml in the last half of 1982 could have been achieved through raising the Ml target and retaining the new operating procedures. Instead, the new procedures were phased out. The funds rate was lowered, primarily as a consequence of a series of reductions in the discount rate, and whatever increase occurred in the rate of growth of M1 was accepted. Initially, this reduction in the funds rate caused the bond market to rally. The market apparently viewed the reduction in the funds rate as a judgment by the Fed that the level of market rates necessary in order to control inflation had fallen. This judgment was apparently accepted by the market on the basis of the sustained reduction in inflation that had occurred and on the basis of the anti-inflationary credibility that the Fed had established in 1981. In retrospect, the process of lowering market rates ended in December when a reduction in the discount rate of half a percentage point left intermediate-term and long-term rates unchanged. By December, investors had again become concerned over a resurgence of M1 growth.

10. Evaluating the October 1979 Operating Procedures

It is difficult to evaluate the post-October 1979 procedures. First, for a variety of reasons, they were not implemented consistently over the interval from October 1979 until their demise in 1982. In spring 1980, they were superseded by the SCRP, the objective of which was to control credit, not money. In early summer 1981, they were overridden. Second, the new procedures were extremely complicated from a technical standpoint. Monetary control was effected through the funds rate. The funds rate was determined indirectly by the level of borrowed reserves, which was in turn determined by the nonborrowed reserves target, given the predetermined demand for required reserves and the demand for excess reserves.

Despite the difficulty in evaluating the new procedures, there is reason to believe that they were not well designed for purposes of monetary control. [A similar conclusion is reached in McCallum (1985). Lindsey (1984) reaches a different conclusion.] Most important, they possessed the same basic defect as the pre-October 1979 operating procedures. The new procedures, like the old, effected monetary control through the funds rate. Neither before nor after October 1979 was there a reliable model that could determine the value of the funds rate that would produce the targeted value of the money supply. By default the new procedures, like the old, relied on a simple feedback mechanism whereby, as long as an overshoot of the money supply target existed, the funds rate would rise, and conversely. The presumption was that the old procedures of monetary control had failed not through inherent problems with using the funds rate to effect monetary control, but rather because of strict limitations in the allowable magnitude of changes in the funds rate. Similarly, it was assumed that the new procedures would work because of the virtual elimination of a constraint on the magnitude of changes in the funds rate.

The simple feedback mechanism of the new monetary control procedures for determining borrowed reserves and the funds rate, taken in combination with the lags inherent in monetary control, appear in retrospect to have produced an overshooting and undershooting of the funds rate necessary in order to

[8] The following discussion is contained in the annual report of open market operations for 1982 by the New York Desk:

> . . . it was clear that mechanical adherence to reserve path procedures would result in a borrowing gap in the final two weeks of around $900 million (even before any allowance for special situation borrowing), implying considerable upward interest rate pressure. The Committee reviewed recent developments at a conference call on September 24. It was the Committee consensus that some accommodation of the more rapid growth of money was consistent with the directive adopted at the August meeting in view of the strength in NOW accounts, the overall weakness in-the economy, and **the fragility of worldwide financial conditions.** Hence, the nonborrowed reserve path was adjusted to limit implied borrowing to the $500 million to $550 million area. [italics added] ["Monetary Policy . . ." (1983), p. 53]

achieve the M1 target.[9] Judged by the experience in the last half of 1980 in particular, a money supply and funds rate cycle would begin with a funds rate too low to prevent a monetary acceleration. Initially, the monetary acceleration would proceed while the funds rate would be little changed, but later the funds rate would rise sharply.[10] This behavior of the funds rate may have been produced by the administration of the discount window. When banks had been out of the discount window, a rise in borrowed reserves would initially have little impact on the funds rate. After banks had been in the window for some time, however, the new, higher level of borrowed reserves would produce a sharp rise in the funds rate. The sharp rise in the funds rate in time would produce a monetary deceleration and an eventual sharp drop in the funds rate.[11]

11. Summary

In the preceding paragraphs, a chronological account was offered of the formulation and implementation of monetary policy in the early 1980s. The character of monetary policy during this period was shaped by a concern over the high rate of inflation. It is, nevertheless, misleading to speak of a monetarist experiment. Policy actions were not guided by a rule.

The post-October 1979 operating procedures incorporated significant concessions to monetary control. Short-term targets for M1 were derived from annual targets and significant movement in the funds rate was permitted. The new procedures adopted nonborrowed reserves targeting. Given lagged reserve accounting, however, nonborrowed reserves targeting resulted in a monetary control procedure that worked through the funds rate. The new procedures, then, possessed the same problem as the old procedures, namely, the absence of an analytical model that could be relied upon in practice to determine the value of the Desk's operating variable from the money supply target. Consequently, changes in the funds rate had to be determined by a rule of thumb. It was argued that the new procedures contributed to unnecessary movements in the money supply and interest rates.

[9] Goodfriend et al (1986) address the issue of whether the new procedures induced cyclical movements in the funds rate and, by implication, the money supply. According to their analysis, the resolution of this issue depends upon whether the level of borrowed reserves was set using the rule of thumb outlined in the initial descriptions of the new procedures or whether it was set on the basis of an analytical model capturing the relationship, running through the funds rate, between borrowed reserves and M1. Which assumption is a more appropriate description of the post-October 1979 operating procedures is an empirical issue not dealt with in their paper.

[10] Examination of the annual reviews of open market operations published in the Federal Reserve Bank of New York **Quarterly Review** reveals that only twice was the target for nonborrowed reserves chanced promptly upon the first appearance of a miss of the M1 target (March 1980 and May 1981). (The nonborrowed reserves target was changed on other occasions in response to a persistent miss of the M1 target.) Prompt alterations of the nonborrowed reserves target after an M1 target miss would have evened out this temporal pattern of the funds rate.

[11] Furthermore, the inflationary environment of the early 1980s and the rise in the magnitude of the government deficit seemed to produce a belief among participants in the bond market that the level of interest rates would have to rise in order to contain inflation. There was, however, great uncertainty over what rise in interest rates would be required. In this uncertain financial environment, participants in the bond market watched the funds rate closely for information as to the Fed's judgment of what rate of interest would provide for monetary control. Consequently, changes in the funds rate were passed on to the entire maturity spectrum of interest rates.

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REAL BUDGET DEFICIT IMPLICATIONS OF GRAMM-RUDMAN-HOLLINGS

*William G. Dewald**

My article in the November/December 1985 issue of this *Review* explained how implementing the August 1985 Congressional Budget Resolution would have virtually eliminated the deficit in real (or inflation-adjusted) terms in the next few years.[1] In December, the Gramm-Rudman-Hollings (GRH) balanced-budget law was enacted. It mandates reducing the nominal budget deficit by about $35 billion per year, achieving balance in 1991. The present note translates GRH nominal deficit targets into real terms on the basis of Congressional Budget Office (CBO) inflation projections made in February 1986. This conversion is important to the extent that real- not nominal-deficits influence saving, investment, and international capital flows. There are two equivalent ways to measure the real budget deficit correctly :

- One is to calculate the annual change in the outstanding federal debt in real terms. As the table shows, at the beginning of fiscal 1986, the nominal federal debt was $1,509.9 billion. At the end of fiscal 1986, if the CBO deficit projection is achieved, the debt will be $1,714.6 billion, an increase of $204.7 billion. Given the 3.4 percent projected inflation rate for 1986, that debt would be worth only $1,658.2 billion ($1,714.6 billion/1.034) in terms of 1985 prices. Hence the real deficit in terms of 1985 prices would be $148.3 billion ($1,658.2 billion - $1,509.9 billion).

- The other way to calculate the real budget deficit is to subtract from the nominal deficit the depreciation in the value of outstanding federal debt due to inflation. For example, the projected 1986 nominal deficit of $204.7 billion is adjusted for inflation by subtracting the 3.4 percent projected depreciation in the value of outstanding federal debt due to inflation. Then this difference is deflated by the price level in terms of 1985 prices to obtain, as before, a $148.3 billion real deficit,

$$\frac{\$204.7 \text{ billion} - (.034 \times \$1{,}509.9 \text{ billion})}{1.034}.$$

If annual inflation should stabilize at 4.1 percent by 1991 as CBO projected and GRH nominal deficit targets are met, these calculations show that the outstanding federal debt-to-GNP ratio would peak at 41.3 percent in 1987 and then begin to decline. The debt to GNP ratio is recorded in the table and plotted in Chart 1. Correspondingly, the real deficit would decline each year beginning this year until it was eliminated in 1989, two years before the nominal deficit is eliminated. The real deficit is also presented in the table and plotted in Chart 2. By 1991, when GRH targets a balanced budget, these calculations based on CBO inflation and GNP projections show that there would be a real federal budget surplus equal to 1.4 percent of GNP. Thus, even moderate inflation, once taken into account, has a substantial effect on the measurement of federal budget deficits, which was the main point of my earlier article.

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[1] William G. Dewald, "CBO and OMB Projections, Adjusted for Inflation, Show Federal Budget Deficit under Control.," Federal Reserve Bank of Richmond, **Economic Review** (November/December 1985), pp. 1.5-22.

GRAMM-RUDMAN-HOLUNGS REAL DEFICIT PROJECTIONS

(Fiscal Years, Billions of Dollars, and Percent)

Fiscal Year	(1) Nominal Deficit	(2) Publicly Held Debt[d]	(3) Inflation[e]	(4) Price Level 1985=100	(5) Real Deficit	(6) GNP[e]	(7) Real GNP	(8) Nominal Deficit/ GNP (1)/(6)	(9) Real Deficit/ Real GNP (5)/(7)	(10) Publicly Held Debt/ GNP* (2)/(6)
1984[a]	185.3	1,141.8	3.8	96.5	147.1	3,695	3,829	5.0	3.8	35.5
1985[a]	212.3	1,312.6	3.6	100.0	165.0	3,937	3,937	5.4	4.2	38.4
1986	204.7[b]	1,509.9[a]	3.4	103.4	148.3	4,192	4,054	4.9	3.7	40.9
1987	144.0[c]	1,714.6	4.0	107.5	70.2	4,504	4,190	3.2	1.7	41.3
1988	108.0[c]	1,858.6	4.1	111.9	28.4	4,838	4,324	2.2	0.7	40.6
1989	72.0[c]	1,966.6	4.1	116.5	-7.4	5,214	4,476	1.4	-0.2	39.1
1990	36.0[c]	2,038.6	4.1	121.3	-39.2	5,619	4,632	0.6	-0.8	36.9
1991	0.0[c]	2,074.6	4.1	126.3	-67.3	6,047	4,788	0.0	-1.4	34.3

Source: Congressional Budget Office, The Economic and Budget Outlook, February 1985 and 1986 except as noted.

[a] Actual.

[b] CBO, An Analysis of the President's Budgetary Proposals for Fiscal Year 1987, February 1986, Summary Table 1, p, viii.

[c] Legislated targets.

[d] Beginning of fiscal year. Projected financing other than borrowing from the public 1987-1991 assumed zero.

[e] CBO projections, 1986-1991.

[f] Publicly held debt, end of fiscal year.

Chart 1

PUBLICLY HELD DEBT RATIO

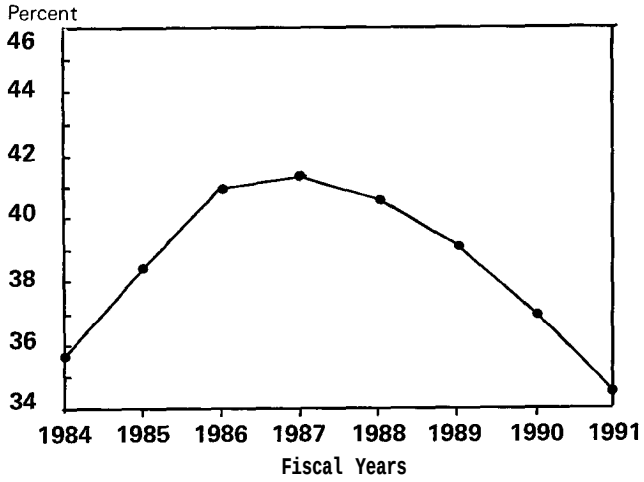

Chart 2

GRAMM-RUDMAN-HOLLINGS
Deficit Projections