

Economic Review



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of Reducing Inflation

Payment of Interest
on Reserves

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By Craig S. Hakkio and Bryon Higgins

Bringing down inflation reduces production and employment in the short run. In the long run, though, low inflation enhances the economy's production potential. Empirical evidence suggests that the long-run benefits of low inflation exceed the short-run costs of reducing inflation.

Payment of Interest on Reserves

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By Stuart E. Weiner

Should the Federal Reserve pay interest on reserves that depository institutions hold against deposits? Paying interest on reserves would improve equity and economic efficiency. But it could complicate the conduct of monetary policy.

Costs and Benefits of Reducing Inflation

By Craig S. Hakkio and Bryon Higgins

The Federal Reserve announced a new program in October 1979 to reduce inflation. By emphasizing control over the supply of bank reserves to achieve objectives for the growth of money and credit, the program contributed substantially to reducing inflation. Progress against inflation, however, was accompanied by a severe recession that pushed rates of unemployment and business failures to post-war highs. Although the economy has recovered sharply from the recession and has been expanding since late 1982, production is still somewhat below the economy's full potential. Clearly, the short-run costs of disinflation have been high.

The high short-run costs of bringing down inflation have led some to question whether further efforts to reduce inflation are worthwhile. Though admitting that inflation causes economic inefficiency, they maintain that the

costs of disinflationary policies are simply too high to justify continued monetary restraint to achieve price stability.

This article argues that the long-run benefits of low inflation exceed the short-run costs of reducing inflation. The first section explains why low inflation improves economic efficiency and leads to economic benefits. The second section shows why reducing inflation is costly in terms of temporary reductions in production and employment. The third section

The costs of inflation are cumulative. They continue as long as inflation remains.

presents empirical estimates consistent with the view that the long-run benefits of low inflation exceed the short-run costs of reducing inflation.

Benefits of price stability

Benefits of price stability reflect the absence of the costs of inflation. Inflation is costly in

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several respects. These costs can be avoided by achieving and maintaining reasonable stability in the aggregate price level.

What constitutes "reasonable price stability" is to some extent subjective. Double-digit inflation like that in the late 1970s clearly does not qualify. But neither does reasonable price stability require zero measured inflation every year. Reasonable price stability is best defined as "a situation in which expectations of generally rising (or falling) prices over a considerable period are not a pervasive influence on economic or financial behavior."¹

The social and political costs of inflation are impossible to measure. It has been claimed that, "Inflation...increases the sense of felt injustice and causes alienation."² For example, inflation—especially if unanticipated—may make social tensions worse by shifting the distribution of income and wealth arbitrarily. Savers are hurt and borrowers helped when inflation unexpectedly reduces the real burden of debt. Similarly, persons with fixed incomes suffer when inflation erodes their purchasing power. In these and other ways, inflation exacerbates social tensions by fostering the perception that the system of economic rewards is unfair. The resulting sense of powerlessness and resentment contributes to political friction. Although a stable price level would alleviate these frictions, the benefits of the alleviation cannot be quantified. For that reason, this analysis focuses on the economic benefits of price stability, which can be estimated in quantitative terms.

The economic benefits of price stability reflect the improvement in economic effi-

ciency when distortions from inflation are removed. The costs of inflation can be measured by the amount of real output lost because of the misallocation of resources or other economic inefficiencies caused by inflation. These costs are cumulative, because they continue as long as inflation remains. Every year that distortions from inflation recur, the average standard of living is reduced. These costs fall into three major categories.³

The first category of costs results from the use of resources by businesses and households to protect themselves against anticipated inflation. For example, both businesses and households devote additional resources to cash man-

Policies to lower inflation cause temporarily higher unemployment and lower economic growth.

agement when inflation is high. Because inflation erodes the purchasing power of money, asset-holders have incentives to keep their holdings of noninterest-bearing cash to a minimum. As a result, individuals make more trips to the bank and firms adopt such techniques as lock boxes and cash concentration accounts when inflation is high. Some of the need for intensive cash management in an inflationary environment results from legal ceilings on deposit interest rates. But, even if deposit ceiling rates were removed, resources would still be used to economize on holdings of currency and reserves. Resources devoted to reducing cash balances are wasted. If not wasted on the socially nonproductive enter-

¹ Paul Volcker, "We Can Survive Prosperity," a speech before a joint meeting of the American Economic Association and the American Finance Association, San Francisco, California (December 28, 1983), p. 5.

² Robert J. Buchanan and Richard E. Wagner, *Democracy in Deficit*, Academic Press, 1977, p. 64.

³ For further discussion of the costs of inflation, see Dean W. Hughes, "The Costs of Inflation: An Analytical Overview," *Economic Review*, Federal Reserve Bank of Kansas City, November 1982, pp. 3-14, and Stanley Fischer, "The Benefits of Price Stability," *Price Stability and Public Policy*, proceedings of an economic symposium sponsored by the Federal Reserve Bank of Kansas City, 1984.

prise of cash management, these resources could be used to produce goods and services that would improve the overall standard of living. Similarly, from society's point of view, resources used in frequent changes in price lists because of an upward trend in the general level of prices serve no useful purpose.

The second category of costs results from distortions caused by the interaction of inflation with the tax system. Because taxes are not indexed for inflation, the real tax burden increases with inflation, whether anticipated or not; and this increased tax burden causes distortions that reduce real output. For example, "bracket creep" pushes individuals into higher tax brackets, reducing the incentive to work and save. Inflation also reduces tax allowances for depreciation to less than would be necessary for firms to replace existing capital, thereby reducing incentives to invest. Moreover, when inflation artificially raises gains in the value of inventories, businesses must pay taxes on illusory inventory profits. As a result, after-tax profits and therefore real investment are depressed. Similarly, inflated gains on assets sold by individuals are taxed, impeding the mobility of capital and distorting the choice of assets. In all of these ways, the interaction of inflation with the tax system impairs incentives to work, save, and invest. For this reason, the tax system increases the costs of inflation. Personal income tax rates will be indexed for inflation beginning this year, reducing somewhat the cost of inflation.

⁴ The recent Treasury Department study of the tax system recommends more extensive indexation of taxes, including indexation of business taxes and capital gains. However, Congressional reaction to the overall plan has been unenthusiastic, suggesting that further indexation may not be implemented in the near future. If it were, the costs of inflation would be lowered.

Many of the costs of inflation discussed in this article are due to what Stanley Fischer has called "institutional nonadaptations" (Stanley Fischer, "Benefits of Price Stability"). Strictly speaking, these costs cannot be attributed solely to inflation but

However, because business taxes and capital gains taxes are unlikely to be indexed for inflation in the near future, the tax system would continue distorting economic decisions in an inflationary environment.⁴

The third category of costs is caused by the increase in uncertainty about prices. Although the reasons are not completely understood, uncertainty about the overall price level and about relative prices tends to increase with inflation. In part, this reflects the tendency for the variability of inflation to increase as the average inflation rate increases. Although higher and more variable inflation is not inherently less predictable, empirical evidence suggests that uncertainty about the price level increases as the overall level and variability of inflation increase.⁵ This is destructive because uncertainty about the price level reduces willingness to invest in financial assets and reduces the willingness to enter into long-term agreements of all kinds. By so doing, inflation interferes with the allocative efficiency of the price system. Uncertainty about relative prices means individuals and firms are less responsive to changes in relative prices. Consequently, production is reduced because resources do not flow to their most productive use.

The sum of the economic costs of inflation can be significant. The important point is that these costs continue as long as inflation continues. They are recurring costs that can be eliminated only by lowering inflation and can

must be attributed to the interaction of inflation with current institutions and laws. Nonetheless, after describing how interest ceilings on deposits and the tax system interact with inflation to produce economic inefficiency, Fischer concludes that "... nominal thinking and nominal institutions are deeply imbedded in the structure of the economy. That is one of the main reasons price stability should be a goal of policy" (p. 38).

⁵ For evidence, see Stanley Fischer, "Benefits of Price Stability," p. 38.

be reduced only by adapting tax laws and other institutions to a permanently high rate of inflation.

The costs of disinflation

In light of the high costs of inflation, the question arises why it has been allowed to persist. The answer is that bringing down inflation is also costly. Policies to lower inflation are likely to cause temporarily higher unemployment and lower economic growth.

Higher unemployment induced by disinflationary policies causes a variety of social and psychological costs. Loss of one's job can lead to frustration, despondency, and family hardships. Like the social costs of inflation, the psychological costs of higher unemployment resulting from disinflationary policies are difficult to measure.

The economic costs of disinflation, however, can be measured by the loss in production and income below levels that would result from accommodating inflation. These costs result from slow adjustment of wages, prices, and expectations to a slowdown in the growth of aggregate spending caused by disinflationary policies. As a consequence of this slow adjustment, disinflationary monetary policies temporarily slow economic growth and impose cumulative losses in output. These losses can be used as a measure of the economic cost of disinflation.

Sources of slow adjustment

Wages adjust slowly to changing economic conditions because of both explicit and implicit labor contracts. Explicit labor contracts are common in unionized industries. Most such contracts establish wage increases for a three-year period. Workers' and firms' expectations of future inflation are built into the wage agreement. That is, expectations of

high inflation over the contract period lead unions to demand commensurately rapid growth in wages and lead firms to agree to the demands. Even in nonunionized industries, implicit contracts between employers and employees can impart inertia to growth in wages. Due to both implicit and explicit labor contracts, a slowing in the rate of inflation may not be reflected immediately in slower growth in wages.⁶

Prices also adjust slowly to changing economic conditions. The initial response of firms to a slowing in sales may be to build up inventories without changing their selling prices. If the slowdown persists, the firms may next reduce output by cutting back on overtime, allowing their work forces to decline through attrition, and in some cases, laying off workers. Firms with considerable market power may consider changing their pricing policies only as a last resort to balance the supply of and demand for their products. As a result, a slowdown in aggregate spending growth is not immediately reflected in slower increases in product prices.

Expectations of future inflation do not adapt quickly to changes in the actual inflation rate. After a prolonged period of high inflation, both workers and firms come to expect high inflation to continue. They have long memories and are not easily convinced that a decline

⁶ The costs of disinflation, like the costs of inflation, result largely from institutional nonadaptations. For example, wage contracts fully indexed to the rate of inflation would make nominal wages more responsive to changes in the inflation rate. As a result, employment and output would not be so affected by disinflationary policies.

⁷ Increased public confidence in the credibility of policymakers' stated intentions to reduce inflation would make expectations, and thus wage-setting and price-setting behavior, more flexible. As a result, improved credibility would reduce the costs of disinflation. For a fuller discussion, see Bennett McCallum, "Credibility of Monetary Policies to Achieve Price Stability," *Price Stability and Public Policy*, 1984.

in inflation for a short period will not be later reversed. As a result, declines in the expected rate of inflation lag behind declines in the actual rate of inflation.⁷

Consequences of slow adjustment

Because of slow adjustment, disinflationary monetary policies can temporarily reduce production and income. The cumulative loss in output that results is the most commonly used measure of the economic cost of disinflation.

An example will help show why disinflation is costly. Assume that inflation has been running at a double-digit rate for a long time before the Federal Reserve announces a program to bring inflation down by reducing growth in money and credit. Some commentators express doubt that the Federal Reserve will persist in its efforts long enough to reduce

Whether disinflationary policies are worthwhile depends on the benefits of price stability relative to the costs of reducing inflation.

inflation. This skepticism contributes to a wait-and-see attitude by firms and workers, many of whom recently signed labor agreements that promised double-digit wage increases to compensate for what was expected to be high inflation over the term of the contract. As money and credit growth slows, growth in total spending declines. Businesses, expecting demand to pick up soon, respond to slackening sales by first accumulating inventories.

As spending growth continues to slow, businesses cut back on production and employment, in part because they cannot raise their prices enough to cover their rapidly rising wage costs. The cutback in production and employment reduces incomes further, leading

to even sharper cutbacks in spending, production, and employment. The economy goes into a recession. As the recession lingers on, inflation comes down gradually. This, together with slack in labor markets, results in new labor contracts requiring more modest wage gains. As a result, businesses post smaller increases in their product prices.

As the economy recovers from recession with a substantially lower inflation rate, concern is again expressed that the Federal Reserve will relent in its efforts to contain inflation during the ensuing economic expansion. Surveys indicate that both businesses and workers still expect relatively high inflation in the next several years and that the public remains skeptical about the resolve of policymakers to consolidate and extend past gains against inflation. In this environment, further efforts to restrain money and credit growth will clearly require another period of subpar economic performance, though probably less severe than the first.

If the scenario seems familiar, it is because of similarities to the experience since the Federal Reserve adopted a disinflationary policy in 1979. Monetary restraint has been accompanied by two recessions, high interest rates, high unemployment, and unprecedented financial strain. Nevertheless, the Federal Reserve has continued its efforts to reduce inflation over time, believing the long-run benefits of lower inflation outweigh the short-run costs of bringing down inflation.⁸

Weighing the costs and benefits

Whether disinflationary policies are worthwhile depends on the benefits of price stability

⁸ The costs of reducing inflation would be more persistent if the temporary reduction in real output lowered investment and reduced the capital stock, thereby reducing future output.

relative to the costs of reducing inflation. Estimating the costs and benefits requires a statistical model of the economy. This section presents results from a model used to estimate the benefits and costs of the reduction in inflation since 1979 and of further reduction that may be made in the next few years.

Three steps were involved in the analysis. First, a simple model of the economy was developed and estimated. Second, the model was simulated to determine the effects of past monetary restraint and to weigh the costs and benefits of the resulting decline in inflation. Finally, the model was simulated to determine the prospective effects of additional monetary restraint and to weigh the costs and benefits of further reduction of inflation.

The empirical estimates from this procedure are not, of course, conclusive. Some economists argue that empirical models of the economy, especially those as simple as the one used here, are unreliable guides to the long-run effects of policy actions. It is true that simulation results from an empirical model are imprecise. Economic models can only capture the average relationship between the variables in the model over some historical time period. Behavior could change in the future, perhaps in response to past or prospective policy changes; or exclusion of some economic variables from a model could bias its forecasts. But policy decisions are typically based on an assessment of the relevant empirical magnitudes. So while the estimates provided in this article are admittedly inexact, they provide some evidence that may be useful to policy-makers in judging whether bringing down inflation is a worthy goal.

The model

A vector autoregression (VAR) model was used in estimating the costs and benefits of lowering inflation. Unlike structural models,

which rely on statistical estimates of numerous behavioral relationships, a VAR model relies only on historical relationships between a few key variables. Because only a few variables are included, a VAR model is preferable in some respects to a structural model and is much easier to use for long-run simulations of the kind needed to study the benefits of low inflation.

The model includes six variables. Since the focus is on the relation between inflation and real output, inclusion of these variables is essential. To make sure that the relationships between the variables of primary interest are captured accurately, other variables also must be included. Money growth was included as the monetary policy variable. The federal government's high employment budget surplus was included as the fiscal policy variable. The relative price of food and energy was included to capture the effect of supply shocks on inflation and real output. And an interest rate was included both to complete the financial market

Past and prospective inflation has been reduced by the monetary restraint program.

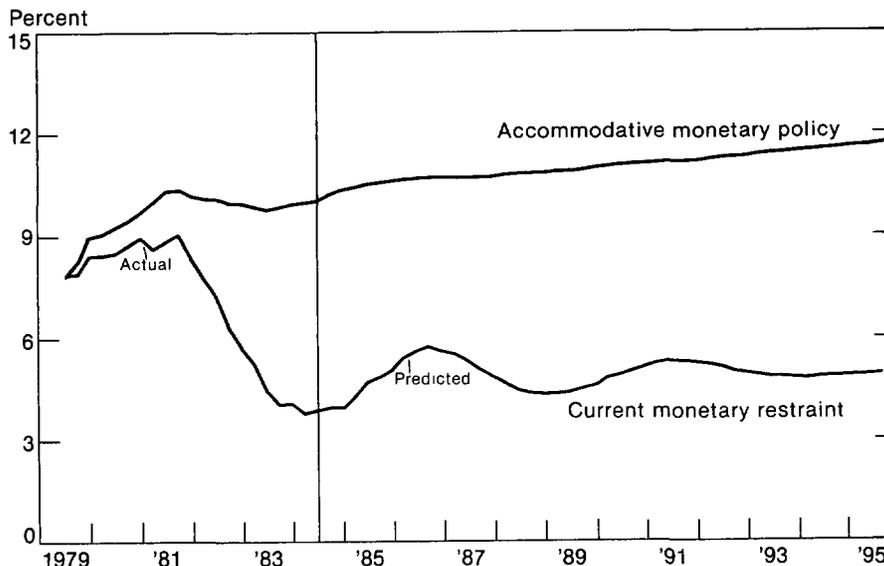
and to capture the effects of inflation expectations. A more detailed explanation of the model is given in the Appendix.

Past disinflationary policies

The model can be used to estimate the effects of the disinflationary monetary policy adopted in October 1979.⁹ Simulation of the model shows how inflation and real output

⁹ The version of the model estimated through the third quarter of 1979 was used for this purpose. This version of the model represents the structure of the economy that prevailed through the 1970s.

CHART 1A
Effects of monetary restraint since 1979
on inflation



would have behaved both with and without monetary restraint.

Effects. The model simulations suggest that past and prospective inflation has been reduced by the monetary restraint program.¹⁰ As shown in Chart 1A, the model predicts that, under the accommodative monetary policy before October 1979, inflation would have accelerated rapidly to double-digit rates by the early 1980s and, if the Federal Reserve had not adopted a policy of monetary restraint in 1979, would have continued to creep upward throughout the simulation period, which ends in 1995.¹¹ In contrast, monetary restraint has

reduced inflation to less than 4 percent currently.

Simulation of the model also shows that the current degree of monetary restraint would allow a modest acceleration of inflation in the future, with inflation averaging about 5 percent for the next 10 years.¹² Despite this acceleration, though, the model simulations indicate that the monetary restraint program adopted in 1979 has cut inflation by more than half.

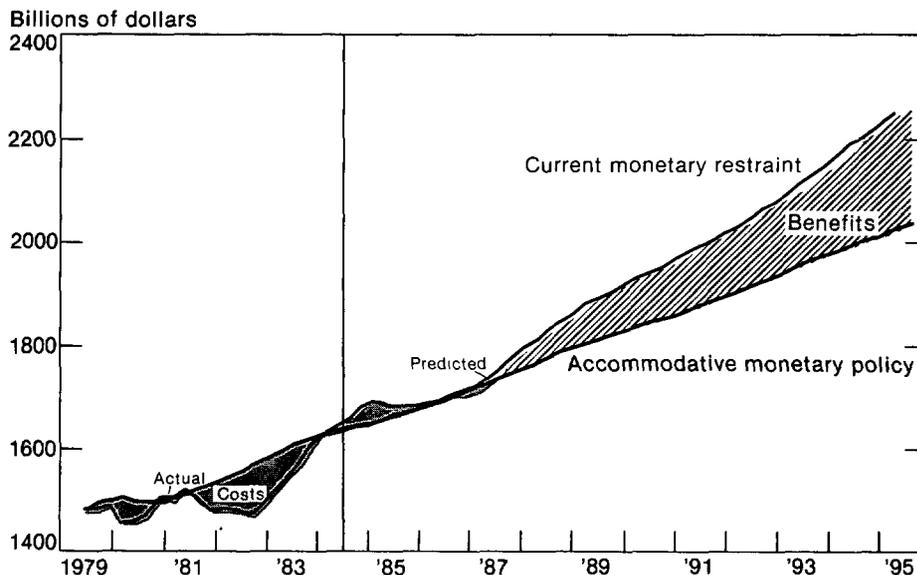
Costs and benefits. The model also indicates that the economic costs of reducing

¹⁰ Strictly speaking, the model cannot attribute the decline in inflation since 1979 solely to monetary restraint. Food and energy prices and other factors may have contributed to lower inflation. However, as shown in the Appendix, the model indicates that money growth is highly correlated with inflation. For expositional purposes, therefore, it is assumed that lower inflation is due primarily to monetary restraint.

¹¹ The values plotted in Charts 1A and 2A are the average growth rates over the preceding two years.

¹² To estimate the benefits of the current degree of monetary restraint, it is necessary to use an updated version of the model. The currently lower inflation could have changed expectations of future inflation and, thus, changed wage-setting and price-setting behavior. To allow for this possibility, the model was reestimated using data through the second quarter of 1984. The details of the reestimated model are given in the Appendix.

CHART 1B
Effects of monetary restraint since 1979
on real output



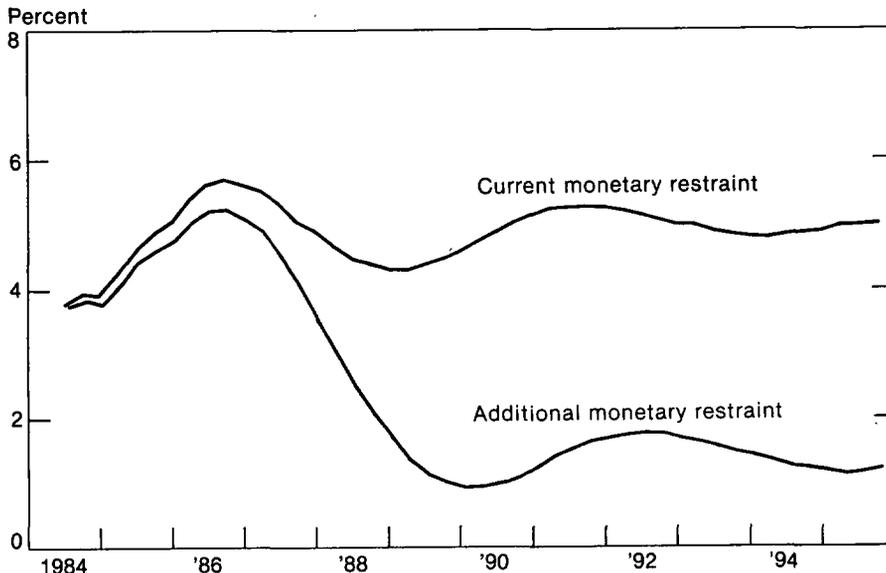
inflation have been high. As shown in Chart 1B, the model suggests that monetary restraint has reduced real output. According to the model, continuation of the accommodative monetary policies in effect before October 1979 would have prevented the recessions of 1980 and 1981-82. The recessions accompanying monetary restraint have kept real output well below the levels that would have been associated with monetary accommodation. Thus, the model simulations suggest that monetary restraint has imposed substantial costs on the economy because of inflexibility in wages, prices, and expectations.

The simulations also indicate, however, that lower inflation will yield economic benefits. As shown in Chart 1B, economic growth will be appreciably higher over the next decade because of improved economic efficiency associated with lower inflation. Consequently, these results indicate that the monetary restraint program adopted in 1979 and the cor-

respondingly lower inflation rate ultimately result in higher output and income than would have accompanied continued monetary accommodation.

The model simulations indicate that the benefits from lowering inflation since 1979 exceed the costs of doing so. Accurate comparison requires considering the costs and benefits of disinflation from the perspective of policymakers when they decided on the monetary restraint program in 1979. The benefits of lower inflation come only after several years in which real output remains below what it would have been if monetary policy had accommodated high inflation. Thus, it is necessary to discount both the costs and benefits of disinflation to arrive at comparable figures in a present-value sense. For this purpose, the difference between real output in the monetary accommodation and monetary restraint simulations, depicted in Charts 1B and 2B, was discounted by a real interest rate of 3 percent. As

CHART 2A
Effects of additional monetary restraint
on inflation



a result of discounting, the present value of both the costs and benefits is somewhat less than is suggested in the charts. Because the benefits occur much later than the costs, the charts overstate the benefits by more than they overstate the costs. The present value of the estimated cost of reducing inflation from the fourth quarter of 1979 through the second quarter of 1984 is \$168 billion of lost output. The benefits of lower inflation after mid-1984, however, total \$688 billion. Thus, the simulations imply that the benefits of lowering inflation to near current levels and keeping it there far exceed the costs of doing so.

Prospective disinflationary policies

Given the favorable estimated outcome from previous reductions in inflation, the question arises whether further lowering inflation would also yield net economic gains. Simulating the model can be used to estimate

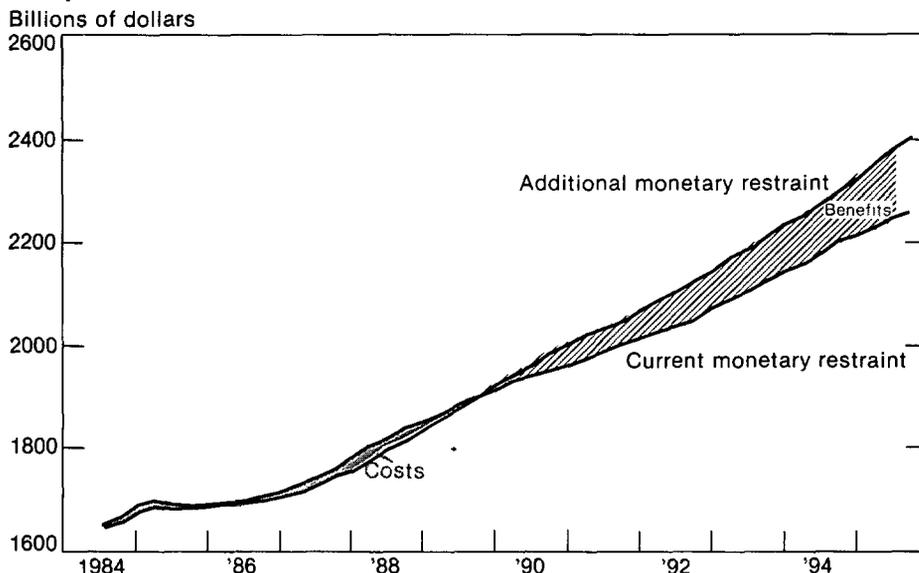
the effects of further reductions in monetary growth and inflation. The model was simulated under two assumptions regarding monetary growth.¹³ The first simulation assumes that the Federal Reserve relents in its program of gradually reducing monetary growth to bring down inflation.¹⁴ The second simulation assumes that the Federal Reserve gradually reduces monetary growth to 1 percent by 1988 and keeps it at that rate thereafter.

Effects. The simulations suggest that further reduction in monetary growth would result in further progress against inflation. As shown in Chart 2A, the model predicts that inflation would accelerate somewhat from current levels if monetary growth were maintained near

¹³ The version of the model estimated through the second quarter of 1984 was used for these simulations.

¹⁴ This simulation is identical to the previous simulation of monetary restraint.

CHART 2B
Effects of additional monetary restraint
on real output



the current rates and would stabilize at about 5 percent in the early 1990s. In contrast, additional monetary restraint that lowered money growth to 1 percent would cause inflation to average less than 1.5 percent in the early 1990s.

The simulations also indicate that lowering money growth would increase economic output. As shown in Chart 2B, the model simulations suggest that additional monetary restraint would result in slightly lower economic growth in the second half of the 1980s. However, the resulting reductions in inflation and consequent improvement in economic efficiency would cause higher economic growth in the early 1990s. According to the model, therefore, further reduction in monetary growth would lead ultimately to higher real output.

Costs and benefits. According to the simulations, the economic benefits of lowering money growth and inflation from current lev-

els exceed the economic costs. The present value of the lower level of economic activity in the next few years resulting from additional monetary restraint is only about \$28 billion. The present value of the higher output through the mid-1990s associated with lower inflation is \$303 billion. Thus, the simulations imply

Estimates suggest that the economic benefits of reducing inflation far outweigh the economic costs.

that the costs of further reducing inflation are much less than the resulting benefits, even after allowing for the fact that the benefits accrue long after the costs are incurred.

Conclusion

Quantitative estimates from the model used in this article suggest that the economic bene-

fits of reducing inflation far outweigh the economic costs. Although different models would undoubtedly yield somewhat different estimates, the analysis in this article provides several important insights.

First, both the costs and the benefits of disinflation must be considered in evaluating alternative monetary policies. Previous studies have estimated the costs of disinflation or the benefits of price stability separately, but none has used a unified framework of analysis to estimate both. As a result, policymakers have had very little empirical evidence to rely on in deciding whether bringing down inflation is worthwhile.

Another important finding is that the economic benefits of lowering inflation are realized long after the associated costs. According to the estimates in this article, the monetary restraint program adopted in 1979 has only recently contributed to better performance of the economy.¹⁵ Moreover, the economic bene-

fits from past and prospective monetary restraint would be realized primarily in the 1990s. In the meantime, real income will remain lower much of the time than it would be with an accommodative monetary policy.

As a result of the long lag between initiating a disinflationary monetary policy and realizing the resulting improvement in economic performance, the Federal Reserve must take a farsighted view of its policies. Focusing only on the short-run effects of monetary restraint would impart an inflationary bias to monetary policy. Such a bias could lead policymakers to a series of decisions not in the long-run best interest of the nation's economic wellbeing.

¹⁵ Strictly speaking, one cannot attribute the current strength of the economy solely to the monetary restraint program adopted in 1979. In particular, the monetary expansion in 1982, the large budget deficits, and the change in tax policy have all contributed to the current strength. However, the improvement in consumer and business confidence resulting from lower inflation has also contributed.

Appendix

This appendix presents a detailed description of the vector autoregression (VAR) used to estimate the costs and benefits of reducing inflation and discusses how robust those estimates are likely to be.

Description of the VAR

A VAR does not rely on a particular economic theory to determine which variables are most important in explaining the behavior of other variables. Instead, all of the variables included in the VAR are assumed to help explain the behavior of each of the other included variables.

The six variables included in the VAR used in this article are listed in Table 1. Only the interest rate variable warrants elaboration. A weighted average of several interest rates was used. The principal components statistical procedure was used to select the weights on the long-term Treasury bond yield, the 6-month commercial paper rate, the Baa corporate bond yield, the dividend-price ratio, the 3-month Treasury bill rate, and the prime rate to construct the interest rate variable. Six lagged values of this variable and the other five variables in the model were included as explanatory variables in each equation of the VAR.

The results of estimating the VAR through the third quarter of 1979 are summarized in the top panel of Table 1. The sum of coefficients on each of the variables in each equation is reported. While this table disregards some useful information, it does provide a convenient summary of the results. For those variables that were significant in explaining another variable, the sum of coefficients is accompanied by an asterisk, *. In addition, those variables that had at least one significant lag coefficient are accompanied by a plus sign, +. Since the focus of this article is the effect of inflation on output growth (Q), the output equation is of primary concern. In the real output equation, lagged inflation has a significant, negative effect on real output growth. A rise in inflation of one percentage point, all else the same, leads to a reduction in output growth of .93 percentage points.

The results of estimating the VAR through the second quarter of 1984 are summarized in the bottom panel of Table 1. The results are similar in most respects to those for the shorter sample period. However, in the income equation, the sum of coefficients on money growth is much smaller than for the earlier version of the model and is statistically insignificant. Although the effect is insignificant, for simulation purposes the "best guess" is that lagged inflation has a negative impact on output growth, consistent with the view that higher inflation reduces output growth. In addition, while there may be some concern about the lack of statistical significance, some economists feel that the issue of statistical significance of coefficients is not relevant for the interpretation of VAR results.¹⁶ Nonetheless, significance of coefficients is indicated in Table 1 for those who think traditional statistical criteria important in evaluating a VAR.

¹⁶ For a discussion of this point, see Christopher A. Sims, "Macroeconomics and Reality," *Econometrica*, January 1980, p. 18.

Robustness of the results

Empirical findings are considered robust to the extent that they are insensitive to the precise specifications of the model used. Robustness can be determined by experimenting to see whether alternative models would yield similar results. Several such experiments were conducted to determine the robustness of the finding that the economic benefits of reducing inflation exceed the costs.

It was initially hoped that simulations from a structural econometric model could be used to supplement the VAR results. Some object to the use of structural models; others, to the use of VAR models.¹⁷ But to simulate a large structural model, it is necessary to specify the values of a large number of "exogenous" variables. Some of the variables taken as exogenous for short-run forecasting are endogenous over a longer run horizon. Thus, changing the path for one exogenous variable, such as monetary growth, can lead to implausible results unless other exogenous variables are also changed in a mutually consistent way. Indeed, there may be no solution for the models when one exogenous variable is changed substantially from the baseline path constructed by the model-builders. Preliminary experiments with two large structural models, the DRI macro model and the MPS macro model, indicated that a large expenditure of manhours and computer time would be necessary to use these models to estimate the costs and benefits of reducing inflation. However, the MPS model was used over its normal five-year forecasting horizon to estimate the costs of reducing inflation. The results were remarkably close to those reported in this article, indicating some degree of robustness for the cost aspect of the cost-benefit comparison.

¹⁷ For a critique of structural models, see Robert Lucas and Thomas Sargent, "After Keynesian Macroeconomics," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Spring 1979.

TABLE 1
Sum of lag coefficients

Equation	Variable						Constant	R ²
	M	Q	P	SURP	PEF	INT		
1955:Q2 to 1979:Q3								
M	1.277*, +	-.194	-.266	-.107	.050	-1.348	.840	.70
Q	.944*	-.288	-.933*	-.256 +	-.070	-3.461	4.092 +	.54
P	.234*, +	.208 +	.741*, +	.036	.154 +	1.864*, +	-.059	.87
SURP	.784	.259 +	-.451 +	.608 +	-.369 +	9.989	-3.347	.49
PEF	.148	.320 +	.148	-.135	.406*, +	1.421 +	-2.209 +	.50
INT	.036 +	.027	-.021	.002	.018 +	.402 +	-.126	.71
1955:Q2 to 1984:Q2								
M	.907*, +	-.111	-.028	.125 +	.036	-1.637 +	1.059	.63
Q	.352 +	.118	-.512	-.216 +	.039	-2.959	3.499 +	.50
P	.208*, +	.056 +	.691*, +	.002	.210*, +	1.183 +	.106	.83
SURP	.063 +	.926*, +	-.000 +	-.687*, +	-.199 +	5.151	-4.699 +	.39
PEF	-.038	.316 +	.204 +	-.028	.448*, +	-.743	-1.601	.44
INT	.047 +	.052 +	-.018 +	-.001 +	.054	.279 +	-.250	.63

Note: A* denotes that the sum of lag coefficients is significant at the 10 percent level.

A + denotes that at least one of the lag coefficients is significant at the 10 percent level.

The variables are:

M = growth rate of M1;

Q = growth rate of real GNP;

P = rate of inflation;

SURP = change in the real value of the high employment budget surplus;

PEF = growth rate in the relative price of energy and food; and

INT = change in the nominal interest rate.

In addition, several different versions of VAR models were used to test the robustness of the results. Various measures of the fiscal policy variable were tried; the 3-month Treasury bill rate was used in place of the weighted average interest rate; several different lag lengths were used; various of the six variables were dropped; and the trade-weighted exchange rate, capacity

utilization, and growth in the monetary base were included in alternative VAR models. None of these alternative specifications changed the conclusion that the long-run benefits of price stability exceed the short-run costs of achieving it, further evidence that the results reported in this article are relatively robust.

Payment of Interest on Reserves

By *Stuart E. Weiner*

Commercial banks, savings and loan associations, and other depository institutions are required by law to hold a portion of their assets as reserves against deposit liabilities. These reserve requirements, in conjunction with control over the supply of reserves, effectively place an upper limit on deposit creation and thus help the Federal Reserve control the growth of money and credit.

But reserve requirements also impose a cost on depository institutions and their customers. Because reserves must be held either as vault cash or in reserve balances at Federal Reserve banks, neither of which currently bears interest, depository institutions are forced to forego interest income. Some of these reserves would be held in the absence of reserve requirements but a good portion would not. The interest that is foregone on involuntarily held reserves is in effect a tax that is either borne directly by the

institutions and their shareholders or passed on to customers via lower deposit rates, higher borrowing rates, or reduced services.

Interest foregone on involuntarily held reserves is in effect a tax.

Although U.S. banking history has seen several episodes of payment of interest on reserves, such payment has effectively been prohibited since passage of the Monetary Control Act in 1980. Recently, however, Congress has been considering legislation that would require the Federal Reserve to pay interest on selected reserves.¹ Such proposals have found support from a variety of sources, including the American Bankers Association, the Federal Deposit Insurance Corporation, the Office

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¹ Strictly speaking, under the Monetary Control Act of 1980 the Federal Reserve already is required to pay interest in the event that, under special conditions, it imposes supplemental reserve requirements. Interest on supplemental reserves would be paid at a rate not to exceed the rate earned on the securities portfolio of the Federal Reserve System during the previous quarter.

of the Comptroller of the Currency, the President's Council of Economic Advisors, and the Board of Governors of the Federal Reserve System. Given such broad support and the sweeping momentum of financial and banking deregulation, some movement toward payment of interest on reserves appears likely.

This article examines the implications of paying interest on reserves. The analysis suggests that paying interest on reserves would have a beneficial impact on economic efficiency and equity. However, paying interest on reserves would also introduce complexities and potential problems for monetary policy. Thus, in embarking upon such a path, it would appear prudent to proceed cautiously and slowly.

Banks have in the past earned interest on their reserves.

The article is divided into four main sections. The first section provides an historical survey of payment of interest on reserves from passage of the National Bank Act in 1863 to passage of the Monetary Control Act in 1980. The second section examines the motivation for and details of more recent proposals for paying interest on reserves. The third section discusses the merits of these proposals on equity and efficiency grounds. The fourth section details the complexities that such proposals would create for monetary policy.

History

Reserve requirements have been part of the U.S. banking system for over a century and a half. Today they serve the primary purpose of providing a fulcrum through which monetary policy is conducted. By placing an upper limit on the amount of deposits that the depository system can create, reserve requirements help

the Federal Reserve control the growth of the money supply.²

Under existing law, reserves must be held in noninterest-bearing forms. This has not always been the case, however. Both national banks and state banks have, at one time or another, earned interest on their reserves.

National banks

The distinction between national banks and state banks arose in 1863 with the passage of the National Bank Act. Prior to that time, all banks had been state chartered, all issuing their own notes. A uniform currency did not exist. One of the major drawbacks of the system was the tendency for bank notes to depreciate in value because they were difficult to redeem. Redemption difficulties, in turn, largely stemmed from uncertainty over the soundness of issuing banks in distant locales.

The National Bank Act was designed in part to offset these problems.³ The act established a national currency. Banks that elected to become nationally chartered could issue these national notes; banks that elected to remain

² For a discussion of the role of reserve requirements and recent institutional changes brought about by the Monetary Control Act of 1980 and the Garn-St Germain Act of 1982, see Gordon H. Sellon, Jr., "The Instruments of Monetary Policy," *Economic Review*, Federal Reserve Bank of Kansas City, May 1984, pp. 3-20. For a detailed early history of reserve requirements in the United States, see "The History of Reserve Requirements for Banks in the United States," *Federal Reserve Bulletin*, November 1938, pp. 953-972. Marvin Goodfriend and Monica Hargraves discuss the rationale for reserve requirements through U.S. banking history in "A Historical Assessment of the Rationales and Functions of Reserve Requirements," *Economic Review*, Federal Reserve Bank of Richmond, March/April 1983, pp. 3-21.

³ Another reason for the act's passage was the desire to create a new market for government securities, a market that was needed to finance the Civil War. Under provisions of the act, national bank notes had to be backed by U.S. securities: for every \$90 of notes that a bank issued, it had to deposit \$100 of government bonds with the Comptroller of the Currency.

state chartered could not. The thinking was that most banks would want to become national banks because customers would find the national notes, which were uniformly redeemable, superior to state bank notes, which were not.

The National Bank Act authorized both explicit and implicit payment of interest on reserves. The act established reserve requirements of 25 percent against both national notes and demand deposits. Reserves had to be held in vaults as “lawful money,” that is, as specie (gold or silver) or greenbacks. An exception was made, however, for banks lying outside major cities. Although they faced the same 25 percent requirement, these banks were permitted to hold three-fifths of their reserves as deposits with national banks in major “redemption” cities. Because the receiving (correspondent) banks either paid a deposit rate on these balances or provided compensating services, the outlying banks either earned explicit or implicit interest on this portion of their reserves.

Banking reform continued in ensuing years. In 1864, the National Bank Act was rewritten, lowering reserve requirements for banks in nonredemption cities and increasing the number of redemption cities. In addition, banks in redemption cities other than New York were permitted to hold one-half of their reserves as balances with national banks in New York. Because few banks elected to become nationally chartered, however, legislation was passed in 1865 levying a 10 percent tax on all new state bank notes. This tax effectively prohibited further issuance of state notes and caused a large number of state banks to seek national charters.

Reserve requirements against national notes were eliminated in 1873.⁴ Reserve requirements against demand deposits were retained, however, so explicit and implicit payment of interest on reserves through correspondent

reserve relationships continued. Indeed, these relationships were extended. In 1887, the Comptroller of the Currency was given the authority to designate additional redemption cities, now called “reserve cities,” and to designate the largest of these as “central reserve cities.” Banks in small cities, so-called “country banks,” could hold reserve balances at banks in reserve cities and central reserve cities. Banks in reserve cities could hold reserve balances at banks in central reserve cities.

Despite all these changes—and to some extent, because of them—the national banking system was still seen by some as less than optimal. One problem was the pyramiding of reserves made possible by the correspondent reserve arrangements. This pyramiding led to volatile swings in credit availability and interest rates. As noted above, country banks could hold a portion of their reserves at banks in reserve cities and central reserve cities. The correspondent banks, in turn, could use these funds to meet their own reserve requirements. When seasonal liquidity demands, primarily agricultural, forced country banks to pull reserves out of their correspondent balances, the correspondent banks suddenly found themselves short of reserves. They were forced to call in loans and otherwise restrict the growth of credit, with the result that interest rates tended to rise. These seasonal availability problems were really a manifestation of a much more fundamental problem, however: there was no central bank and hence no way to direct the overall growth of money and credit.⁵

⁴ The abolishment of reserve requirements against national notes appears linked to a need for currency during the panic of 1873; the abolishment released greenbacks that had been used as note reserves. See “The History of Reserve Requirements...,” pp. 955-956.

⁵ For further discussion of the pyramiding problems during the National Bank Act era, see Thomas Mayer, James S. Duesenberry, and Robert Z. Aliber, *Money, Banking, and the Economy*, W. W. Norton, 1981, pp. 38-39.

Legislators eventually responded by enacting the Federal Reserve Act. Passed in 1913, the act established the Federal Reserve as the nation's central bank. All nationally chartered banks were required by law to become members of the Federal Reserve System, subject to its reserve requirements. State-chartered banks could also become members but were not required to do so.

Explicit and implicit payment of interest on reserves through private correspondent relationships came to an end with passage of the Federal Reserve Act. The act retained the distinction between central reserve cities, reserve cities, and nonreserve cities. It eliminated private correspondent reserve relationships, however, by requiring that all reserves be held at the 12 regional Federal Reserve banks. Henceforth, small banks could still hold balances at correspondents, but these balances could no longer count as reserves.

Although explicit payment of interest on reserves was clearly ruled out, implicit interest continued to be earned through what amounted to a correspondent relationship with the Federal Reserve. As members of the Federal Reserve System, banks were entitled to several free services, including, for example, check clearing. These services can be thought of as correspondent services, partially compensating for Federal Reserve reserve requirements. However, with passage of the Monetary Control Act of 1980 and its associated pricing of Federal Reserve services, even this implicit interest was ultimately eliminated. National banks today earn no interest on their reserves.

State banks

State banks have traveled a different road. Near extinction in 1866 following the effective prohibition of state bank notes, state banks made a comeback in the early 1870s as

demand deposits replaced notes as the principal form of bank liability. Since state banks could offer deposits as easily as national banks, their numbers began to swell.

Throughout the National Bank Act era, state banks were subject only to the reserve requirements of their respective states. This was also true after passage of the Federal Reserve Act, provided such banks elected not to become members of the Federal Reserve System. Those who elected not to join—and a good many did not—usually earned interest on their reserves.

Proposals have been advanced in recent years that would permit the Federal Reserve to pay interest on reserves.

Interest was earned by state banks in two ways. First, similar to arrangements among national banks under the National Bank Act, many states permitted demand deposits at correspondent banks to count as reserves. Up until 1933, these deposits could earn explicit interest; after 1933, they still earned implicit interest. Second, many states also permitted government securities to count as reserves. Reserves held in this form earned explicit interest.

All of these arrangements came to an end in 1980, however, when the Monetary Control Act was passed. The act made all depository institutions, including nonmember banks, savings and loan associations, and credit unions, subject to Federal Reserve reserve requirements. Nonmember banks that previously had been earning implicit interest on reserves through correspondent relationships or explicit interest through security holdings were now required to hold noninterest-bearing reserve assets. And, in light of the accompanying provision calling for the pricing of Federal Reserve services, such banks never had the

opportunity to receive compensatory correspondent benefits from the Federal Reserve. Like national banks, state banks today earn no interest on their reserves.

Recent Proposals

Numerous proposals have been advanced in recent years that would permit the Federal Reserve to pay interest on reserves. Unlike the past, however, when interest-bearing reserves have largely been an incidental development, these proposals have had specific purposes in mind. The proposals can conveniently be divided into pre-MCA (Monetary Control Act) and post-MCA proposals.

The primary motivation behind the pre-MCA proposals was to improve monetary control. Throughout most of the postwar period, Federal Reserve membership declined. A major reason for the decline was the relatively high cost of membership. Because nonmember banks could frequently hold interest-earning assets as reserves while member banks could not, Federal Reserve membership imposed a real burden. As a result, a number of existing members decided to leave the Federal Reserve System and a growing number of newly chartered banks decided not to become members in the first place. By the mid-1970s, the membership decline had become so precipitous that the Federal Reserve urged payment of interest on reserves as a way to offset the cost of membership, hoping to prevent further defections.⁶

A declining membership posed monetary control problems for the Federal Reserve because more and more transactions (M1) deposits were escaping Federal Reserve

reserve requirements, subject instead to state reserve requirements. Since reserve requirements differed from state to state, and between the states and the Federal Reserve, a given level of reserves was capable of supporting a vast array of deposit levels, depending on where these deposits ultimately settled. That is, the ratio of deposits to member reserves, the so-called money multiplier, became more and more difficult to predict. Volatility in the multiplier was a problem because it made selection of the level of reserves appropriate for achieving a given monetary target more difficult. Moreover, as funds flowed from member to nonmember banks, the multiplier became larger. A larger multiplier was a problem because it meant that a given shock to the level of reserves would cause a greater change in the money supply, augmenting the potential errors in monetary targeting.⁷

Hoping to stem the flow of funds out of the Federal Reserve System, and thereby improve monetary control, specific proposals to pay interest on reserves were introduced in Congress on behalf of the Federal Reserve in 1977 and 1978.⁸ These proposals received considerable support, but they were ultimately voted down. The major opposition to the bills stemmed from a concern over how such a

⁷ J. A. Cacy and Scott Winningham make these points in "Reserve Requirements Under the Depository Institutions Deregulation and Monetary Control Act of 1980," *Issues in Monetary Policy: II*, Federal Reserve Bank of Kansas City, 1982, pp. 72-75.

⁸ Testimony relating to the 1977 legislation is contained in *NOW Accounts, Federal Reserve Membership and Related Issues*, Hearings before the Committee on Banking, Housing, and Urban Affairs, U. S. Senate, U. S. Government Printing Office, 1977. Testimony relating to the 1978 legislation is contained in *Monetary Control and the Membership Problem*, Hearings before the Committee on Banking, Finance, and Urban Affairs, U. S. House of Representatives, U. S. Government Printing Office, 1978. For a discussion of the proposed legislation, see Goodfriend and Hargraves, "A Historical Assessment. . . ."

⁶ Bryon Higgins documents the membership decline in "Reducing Reserve Requirements as a Solution to the Membership Problem," Federal Reserve Bank of Kansas City Research Working Paper 77-02, October 1977, pp. 2-5.

move would affect Treasury revenues. As discussed in the following section, payment of interest on reserves by the Federal Reserve would lower Treasury revenues.

The push for payment of interest on monetary control grounds was aborted in 1980 when the Monetary Control Act was passed. By establishing universal reserve requirements, the act effectively removed the relative burden of Federal Reserve membership. Henceforth, all depository institutions, both members and nonmembers, were subject to Federal Reserve reserve requirements.

The issue of interest-bearing reserves has not gone away, however. In the years since passage of the Monetary Control Act, proposals to pay interest on reserves have again surfaced in Congress. The primary motivation behind these post-MCA proposals has not been monetary control, however, but deregulation.

Paying interest on reserves would have a beneficial impact on economic efficiency and equity.

Two new accounts, the money market deposit account (MMDA) and the Super NOW account, have provided the impetus for these proposals. Depository institutions were authorized to offer these accounts beginning in December 1982 and January 1983, respectively. The accounts were designed to compete with money market mutual funds (MMMF's) offered by nondepository institutions. Unlike MMMF's, however, Super NOW accounts and nonpersonal MMDA's are reservable. Because noninterest-bearing reserve requirements in effect represent a tax, yields on these accounts have tended to be lower than they otherwise would be, placing these accounts at a competitive disadvantage.

To make these accounts "directly equivalent and competitive with money market mutual funds," Representative Barnard and Senator Heinz introduced legislation in 1982, and again in 1983 and 1984, that would authorize the Federal Reserve to pay a market-related rate of interest on reserves held against nonpersonal MMDA's and Super NOW accounts.⁹ Interest would be paid at the rate earned on the Federal Reserve's security portfolio. Only required reserves held in reserve balances at Federal Reserve banks would be entitled to such payment.

The Barnard-Heinz proposal appears to have support from a variety of sources. There is some support, in fact, for the eventual payment of interest on all reserves, including those held against demand deposits. The possible ramifications of paying interest on reserves are explored in the next two sections.

Efficiency and Equity Issues

Paying interest on reserves would have a beneficial impact on economic efficiency and equity. Because such payments would remove the implicit "reserve tax" that is presently imposed on depository institutions, the institutions would be in a better position to compete with nondepository institutions. This heightened competition would serve to more efficiently channel financial resources to their most productive use. At the same time, overall equity would be enhanced because the reserve tax would be shifted to society at large.

⁹ The bills were originally introduced in December 1982 (H.R. 7341, S. 3059) and were reintroduced in January 1983 (H.R. 1013) and August 1983 (S. 1750). The bills differ only in the timing of the interest payments: under the Barnard (House) bill, interest would be paid quarterly at the rate earned on the System's Treasury portfolio during the previous quarter; under the Heinz (Senate) bill, interest would be paid monthly at the rate earned on the System's portfolio during that month.

Noninterest-bearing reserves as a tax

Noninterest-bearing reserves involuntarily held represent a tax on depository institutions and their customers. Depository institutions can be thought of as holding two types of reserves: voluntary reserves and involuntary reserves. Voluntary reserves are cash assets held to facilitate day-to-day operations. Involuntary reserves are those additional cash assets that must be held in order to meet reserve requirements. When a depository institution is forced to hold more cash assets than it otherwise would, that is, forced to hold involuntary reserves, it must forego earnings on those assets. The institution may simply absorb these lost earnings. Alternatively, it may attempt to recoup them by paying lower rates on its deposits, charging higher rates on its loans, or offering its customers fewer services at higher costs. Regardless of how successful institutions are in passing along this reserve tax, the implicit revenues ultimately find their way to the U.S. Treasury.

Under an informal agreement dating back to the Federal Reserve's earliest years, the Federal Reserve every year turns over its surplus earnings to the Treasury.¹⁰ By not paying interest on involuntary reserves, the Federal Reserve's earnings are higher than they otherwise would be and, as a result, Treasury revenues are higher than they otherwise would be. If the Federal Reserve paid interest on these reserves, the reserve tax would be reduced or eliminated and Treasury revenues would decline.¹¹

¹⁰ Federal Reserve-Treasury transfers are documented in Goodfriend and Hargraves, "A Historical Assessment..." p. 13.

¹¹ The reserve tax would be eliminated only if the Federal Reserve paid exactly the market rate. If it paid instead a market-related rate related in either a proportional or constant spread way, the reserve tax would be reduced but not eliminated.

The reserve tax is not insignificant. In 1983, for example, depository institutions held on average \$38.8 billion in required reserves of which \$16.8 billion was held in vault cash and \$22.0 billion was held in reserve balances at Federal Reserve banks. Assuming the institutions would have elected to hold this vault cash voluntarily, \$22.0 billion represented involuntary reserves. Had the institutions been able to invest these funds in 3-month Treasury bills, they would have earned \$2.0 billion in interest. Had they elected instead to hold a more diversified security portfolio, similar to the Federal Reserve's, they would have earned \$2.2 billion.¹² However measured, the reserve tax is clearly of some magnitude. And, as argued below, it is also a source of inefficiency and inequity.

Efficiency and equity

Noninterest-bearing involuntary reserves are difficult to defend on efficiency grounds. Because of the reserve tax, yields on reservable deposits offered by depository institutions tend to be lower than yields on similar, but nonreservable, instruments offered by nondepository institutions. The yield differential, in turn, makes it more difficult for depository institutions to compete with nondepository institutions. As a result, funds may flow out of the depository system into the nondepository system.

The potential outflow of funds represents an inefficient allocation of financial resources because it is based on artificial prices. The reserve tax can be thought of as a selective excise tax on the deposits offered by depository institutions. Like any other excise tax, it

¹² These estimates overstate somewhat the true magnitude of the reserve tax since depository institutions and/or depositors would pay taxes on these interest earnings.

has the effect of artificially raising the "price" of these deposits (by raising the opportunity cost of holding them) and distorting economic decisions. Because of the artificially high prices, the price system directs financial resources away from what might have been their most productive uses. Paying a market-related rate of interest on involuntary reserves would restore the allocative efficiency of the price system by narrowing, or even eliminating, yield differences among essentially similar competing instruments.¹³

If interest were paid on reserves, the reserve tax would be shifted to the public at large.

Consider, for example, Super NOW accounts, which are reservable transactions accounts offered by depository institutions, and MMMF's, which are nonreservable transactions accounts offered by nondepository institutions. If interest were paid on the involuntary reserves held against Super NOW accounts, their yields would likely rise. As a result, funds that might otherwise have been attracted to MMMF's would now be attracted to Super NOW's. The artificial spread between nonreservable deposit rates and reservable deposit rates would be reduced, permitting the price system to operate more efficiently.

A key question, of course, is how much of the spread would in fact be reduced? If interest were paid on reserves, how much would be passed on to depositors? Although a definitive answer is not possible, it does seem reasonable to believe that competition among deposi-

tory institutions, as well as between depository institutions and nondepository institutions, would force at least some reduction in the spread.¹⁴

Noninterest-bearing involuntary reserves are also difficult to defend on equity grounds. With such reserves earning no interest, depository institutions and their customers are taxed while nondepository institutions and their customers are not. Yet the two groups are essentially similar. A guiding tenet of U.S. tax policy has always been to tax equals equally. Paying interest on reserves would remove the unequal tax, negating any associated inequity.

If interest were paid on reserves, the reserve tax would be shifted to the public at large. Because Treasury revenues would be lower, the federal deficit would be higher. If the Treasury elected to meet the shortfall by raising taxes, all taxpayers, not just depository institution shareholders, deposit holders, and borrowers, would pay. If the Treasury elected instead to simply let the deficit increase, all individuals affected by the larger deficit (through its possible impact on interest rates or inflation), not just depository institution shareholders, deposit holders, and borrowers, would pay. Either way, the previously narrow reserve tax would be more broadly felt.

Prior justification

In an earlier era, before passage of the Monetary Control Act of 1980 and the Garn-St Germain Act of 1982, there may have appeared to have been some justification for not paying interest on involuntary reserves.

¹³ Harry G. Johnson provides a general discussion of efficiency considerations in "Problems of Efficiency in Monetary Management," *Journal of Political Economy*, September/October 1968, pp. 972-981.

¹⁴ According to standard microtheory, the reserve tax (and hence the proceeds of its removal) is completely passed on to depositors if the banking industry is competitive and subject to constant costs; it is shared by depositors and the banks if the banking industry is monopolistic or oligopolistic, or if the industry is subject to rising costs. See Johnson, "Problems of Efficiency . . ." p. 977.

Even then, though, the rationale appeared weak.

As noted earlier, the Monetary Control Act instituted explicit pricing of Federal Reserve services. Prior to that, Federal Reserve member banks received free services, such as check clearing and collection, automatic clearinghouse services, and wire transfers. It was sometimes argued that noninterest-bearing reserves could be viewed as payment for these services. This argument had limited appeal, however, because figures indicated that the interest earnings foregone by the member banks considerably exceeded the Federal Reserve's cost of providing these services.¹⁵ The point was further made that even if the figures had more closely matched, such a payment mechanism was inherently inefficient. Because Federal Reserve services were not explicitly priced, banks had an incentive to overutilize them, resulting in a waste of Federal Reserve resources.

Another possible justification for not paying interest on reserves centered on deposit rate ceilings. Only recently, with the passage of the Monetary Control Act and the Garn-St Germain Act, have certain deposits been permitted to pay market rates of interest; prior to that, ceilings had been set by law. It could be argued that, because banks' costs of funds were artificially low in periods of rising interest rates while at the same time these banks were able to invest these funds at market rates, noninterest-bearing reserves served to hold down artificially high profits, presumably redistributing them (via lower economy-wide taxes) to consumers at large. Although this argument may have appeared to have some merit, it no doubt overstated the extent to

which ceilings held down the cost of acquiring funds. Banks competed for deposits in other ways, among them, by offering free services, free gifts, and special borrowing privileges. And, more importantly, to the extent that the ceilings were effective in limiting true deposit yields, banks probably had some difficulty attracting funds, which would have tended to depress their profitability.

Treasury revenue losses

Whatever its possible merits or demerits in an earlier time, payment of interest on involuntary reserves today would appear consistent with overall equity and efficiency. But what would be the expense to the U.S. Treasury of moving to an interest-bearing regime?

What would be the expense to the U.S. Treasury if the Federal Reserve paid interest on reserves?

As already noted, the Federal Reserve turns over a sizable portion of its earnings to the Treasury. In 1983, for example, Federal Reserve payments to the Treasury totaled \$14.2 billion, representing 2.2 percent of total federal government receipts.¹⁶ If the Federal Reserve paid a market-related rate of interest on involuntary reserves, the amount of transferred earnings would of course decline. The net decline in Treasury revenues would not be as large as the gross interest outlay, though, because bank profits, shareholder dividends, and depositor interest income would all rise, generating some offsetting tax revenues. Still, the net loss to the Treasury could be signifi-

¹⁵ See, for example, Ira Kaminow, "Why Not Pay Interest on Member Bank Reserves?" *Business Review*, Federal Reserve Bank of Philadelphia, January 1975, p. 5.

¹⁶ Figures are taken from *1983 Annual Report of the Board of Governors of the Federal Reserve and Survey of Current Business*.

cant. But it is worth emphasizing again that that *loss* would be a manifestation of the efficiency and equity *gains* brought on by the removal of the reserve excise tax.

It has been estimated that paying interest on reserves in accordance with the proposed Barnard-Heinz legislation—that is, paying a market-related rate of interest on the reserve balances held against nonpersonal MMDA's and Super NOW accounts—would at present produce an annual net Treasury revenue loss of \$160 million. By 1988, at which time all regular NOW accounts will have become ceiling-free Super NOW accounts and all Monetary Control Act reserve requirements will have been fully phased in, the annual net revenue loss would be in the vicinity of \$1.0 to \$1.3 billion. If a market-related rate of interest were paid on the reserve balances of all reservable deposits, including demand deposits, the revenue loss today would be about \$1.2 billion; by 1988 it would likely be \$2.2 billion.¹⁷

Monetary Policy Issues

Just as paying interest on reserves would have important implications for economic efficiency and equity, so would it have implications for monetary policy. Unlike its impact on efficiency and equity, however, its impact on monetary policy would not be unambiguously favorable. Paying interest on reserves would introduce complexities and potential problems for monetary policy because it could complicate the ability to hit monetary targets, could result in undesirable interest rate volatil-

ity, and could even call into question the overall usefulness of monetary targeting as a policy strategy.¹⁸

Paying interest on a limited basis: The Barnard and Heinz bills

Short-run considerations. The Barnard and Heinz bills recently before Congress would authorize the Federal Reserve to pay a market-related rate of interest on reserve balances held against nonpersonal MMDA's and Super NOW accounts. Because such payment would effectively remove the reserve tax on nonpersonal MMDA's and Super NOW accounts, yields on these accounts would probably rise.¹⁹

¹⁸ It is assumed throughout this section that the Federal Reserve has chosen the narrow money stock M1 as an intermediate target, believing that there is a predictable relationship between M1 and the ultimate goal variables, inflation and real income growth. As numerous authors have noted, adoption of a monetary aggregate as an intermediate target implies that policymakers believe that most disturbances to the economy are income disturbances, not portfolio disturbances. See, for example, William Poole, "Optimal Choice of a Monetary Policy Instrument in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, 84, May 1970, pp. 197-216. It is also assumed that, as in the Barnard and Heinz bills, interest is paid only on required reserves held in reserve balances at Federal Reserve banks, the intent being to approximate involuntary holdings. There are other ways to pay interest on reserves, of course. One way, an approach taken by many states prior to the Monetary Control Act, would be to allow depository institutions to count as reserves interest-bearing securities purchased on the open market. The problem with this arrangement is that, although reserves would still provide an upper limit on total deposit expansion, the Federal Reserve would lose control over this upper limit because it would lose control over the total amount of reserves in the system (assuming no non-security reserves had to be held). The alternative approach, maintaining the present reserve structure but paying explicit interest on those reserves, would avoid this problem.

¹⁷ Estimates of the Treasury revenue impact of payment of interest on certain reserves have been provided to the Congress by the Board of Governors of the Federal Reserve System on various occasions. Estimates cited in the text are updates of estimates provided Representative Fauntroy in a letter from Chairman Volcker dated November 8, 1983.

¹⁹ Again (see note 11), strictly speaking, such payment would remove the reserve tax only if the Federal Reserve paid exactly the market rate. The Heinz bill, with its contemporaneous payment, probably comes closer to doing this than the Barnard bill, with its lagged payment. Still, as discussed later in the article, determination of "the" market rate is a difficult issue, not at all straightforward.

Yields on nonpersonal MMDA's would probably rise only marginally, however, since nonpersonal MMDA's are presently subject to a reserve requirement of only 3 percent. And what little change did take place would probably have little effect on M1. M1 might decline slightly as a portion of the funds stored in corporate demand deposits (a component of M1) moved into the more attractive nonpersonal MMDA's (a component of M2 but not of M1). Still, short-run distortions to M1 would likely be minimal, with a minimal impact on the controllability of M1.

Paying interest on reserves would introduce complexities and potential problems for monetary policy.

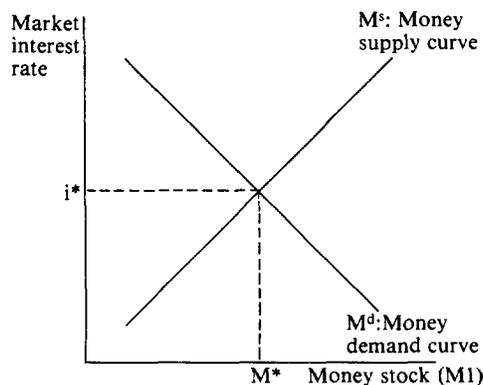
Yields on Super NOW accounts, in contrast, would probably register greater gains, since Super NOW's are presently reservable at 12 percent. And these gains could cause transitional problems for monetary control. As yields on Super NOW accounts (a component of M1) approached yields on nonreservable personal MMDA's and MMMF's (non-M1 accounts), there could be a substantial shift of funds from the latter into the former. The resulting acceleration in M1 growth would temporarily complicate monetary policy by altering the relationship between M1 and the goal variables, inflation and real income. These difficulties would persist only over the short run, however, because eventually policy-makers would identify the new relationship between M1 and the goal variables.

Long-run considerations. The long-run effects on monetary policy of the Barnard and Heinz bills are potentially more far-reaching but difficult to gauge. As in the short run, the nonpersonal MMDA provision of the bills

would have little impact. The Super NOW provision, in contrast, could have a marked impact. Money demand relationships could be altered, with implications for monetary control and interest rate volatility.

To examine the issues involved, it is useful to adopt a simple money demand-money supply framework like that depicted in Figure 1.

FIGURE 1



Market interest rates are measured on the vertical axis and M1 money stock levels are measured on the horizontal axis. M^* is the equilibrium money stock, assumed to be the Federal Reserve's M1 target deemed consistent with sustainable real growth and low inflation. The equilibrium interest rate is denoted by i^* .

In this framework, money can deviate from its target level M^* either because of shifts in the money supply curve or because of shifts in the money demand curve. The money supply curve can shift, for example, as a result of changes in banks' desired holdings of excess reserves or discount window borrowings. Similarly, the money demand curve can shift either because of a change in the transactions demand for money due, say, to higher or lower income growth or to a change in the demand for money versus other assets in the public's investment portfolio.

From a monetary policy standpoint, it is important to distinguish between these two types of money demand shifts. In the case of an income or transactions disturbance, the Federal Reserve would want to offset the effect of the disturbance on money growth. Thus, if money growth exceeded target, the Federal Reserve would tighten policy to return money to target. In contrast, if a shift in money demand resulted from a portfolio disturbance, the Federal Reserve would not want to return money to target; indeed, it would abandon close monetary control. Adherence to monetary targeting in the presence of portfolio disturbances could cause unnecessary fluctuations in income and prices.²⁰

Paying interest on Super NOW reserves in accordance with the Barnard and Heinz bills could affect the likelihood and magnitude of portfolio disturbances. On the one hand, it could cause fewer such disturbances, making it easier for the Federal Reserve to interpret movements away from the desired money stock, M^* . Because such payment would remove the reserve tax on Super NOW's, narrowing or even eliminating the artificial spread between yields on Super NOW's (a component of M1) and yields on alternative nonreservable instruments outside M1, there would be less incentive for such alternative instruments to arise. Consequently, there would be fewer unexpected movements of funds out of M1, that is, fewer unexpected shifts in the money demand curve.²¹ Devia-

²⁰ In the case of a portfolio disturbance, the Federal Reserve would want to change its money stock target in order to return to the original interest rate level.

²¹ The argument that reserve requirements induce alternative nonreservable instruments, and thus impede monetary control, has been advanced by a number of authors. See, for example, Stuart I. Greenbaum, "Legal Reserve Requirements: A Case Study in Bank Regulation," *Journal of Bank Research*, Spring 1983, pp. 59-69.

tions from the desired money stock, M^* , could more confidently be attributed to income disturbances or money supply disturbances, and offsetting open market operations could more confidently be undertaken.

On the other hand, paying interest on Super NOW reserves could cause more portfolio disturbances in money demand, making it more difficult for the Federal Reserve to interpret movements from M^* . Because yields on Super NOW accounts would tend to rise, a larger proportion of funds in M1 would become savings funds or investment funds as opposed to pure transactions funds. Since investors might be expected to move these funds rapidly in and out of M1 as investment opportunities changed throughout the economy, one might expect to see more shifts in the money demand curve.²² This added instability in the money demand curve would make deviations from M^* more difficult to interpret.

Regardless of whether payment of interest on Super NOW reserves increased or decreased the number of shifts in the money demand curve, it very likely would make the money demand curve steeper.²³ This, too, would have implications for monetary control, as well as for interest rate volatility.

By removing the reserve tax, paying interest on Super NOW reserves would permit Super NOW yields to move more closely with mar-

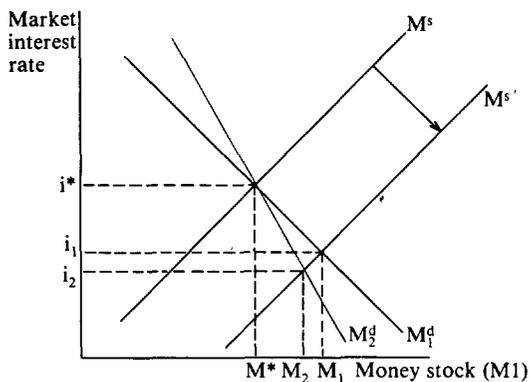
²² Richard G. Davis makes this point in "Monetary Targeting in a Zero Balance World," in *Interest Rate Deregulation and Monetary Policy*, Federal Reserve Bank of San Francisco, 1982, p. 28. Donald Kohn has expressed similar thoughts, paraphrased by David E. Lindsey in "Comment on How Regulations Affect Monetary Control," *Journal of Money, Credit, and Banking*, November 1982, Part 2, p. 791.

²³ The negative slope of the money demand curve reflects the response of households' and firms' demand for money to changes in the opportunity cost of holding money. Opportunity cost is usually measured as the difference between the rate of return on other financial assets (proxied here by the market interest rate) and the rate of return on money. As the opportunity cost of holding money increases, the demand for money decreases.

ket interest rates. This, in turn, would cause the demand for Super NOW accounts to become less interest sensitive because the opportunity cost of holding Super NOW accounts would now not rise as much when market interest rates rose. Less interest sensitivity in the demand for Super NOW's would translate into less interest sensitivity for M1 as a whole. As a result, the demand curve for M1 would become steeper, so that a given increase in market interest rates would be associated with a smaller decline in the amount of money that people would want to hold.

With a steeper money demand curve, a given shift in the money supply curve would cause a smaller deviation from M^* . Thus, in this situation, monetary control would be improved. This point is illustrated in Figure 2.

FIGURE 2

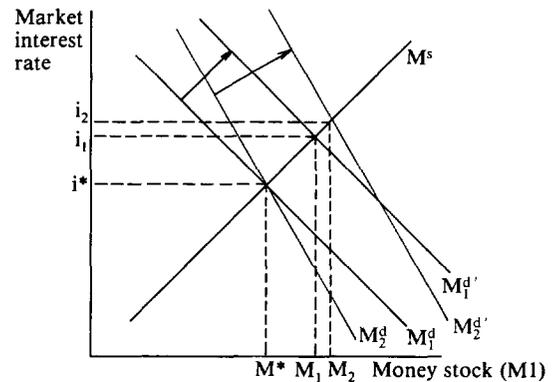


M_1^d is assumed to be the money demand curve prior to payment of interest on Super NOW reserves, while M_2^d is assumed to be the money demand curve after such payment. Suppose the money supply curve, M^s , shifts to the right as a result, say, of depository institutions unexpectedly deciding to hold fewer excess reserves or unexpectedly deciding to increase their borrowings at the discount window. With the old money demand curve, the

new equilibrium money stock would be M_1 . With the new money demand curve, the new equilibrium money stock would be M_2 . Thus, the less interest-sensitive money demand curve would cause smaller deviations from M^* , improving monetary control.

Monetary control would be worsened, however, for shifts in the money demand curve. This point is illustrated in Figure 3. As before,

FIGURE 3



M_1^d is assumed to be the money demand curve prior to payment of interest on Super NOW reserves and M_2^d is assumed to be the money demand curve after such payment. A rightward shift in the old money demand curve generates the new equilibrium money stock M_1 , while an identical shift in the new money demand curve generates M_2 , which is further away from M^* than M_1 . Thus, the less interest-sensitive money demand curve causes greater deviations from M^* , worsening monetary control.²⁴

While the monetary control implications of paying interest on reserves are ambiguous, the

²⁴ If the money demand shift in question was due to a portfolio disturbance, the larger deviation from M^* would really be a moot point. As noted earlier (note 20), in the case of a portfolio shift, the Federal Reserve would want to change its money stock target in order to get back to the original interest rate.

interest rate implications are clear. Payment of interest on reserves would increase the degree of interest rate volatility for both money demand and money supply disturbances. As indicated in Figure 2, a rightward shift in the money supply curve, M^s , no longer generates the new equilibrium interest rate i_1 , but the lower rate i_2 . Similarly, in Figure 3, a rightward shift in the old money demand curve M_1^d generates the new equilibrium rate i_1 , but an identical shift in the new money curve M_2^d generates the higher rate i_2 . In both cases, the less interest-sensitive money demand curve causes greater deviations from i^* , increasing interest rate volatility.²⁵

Paying interest on a universal basis

All of the potential advantages and disadvantages of paying interest on Super NOW reserves would intensify in 1986 when, under mandate of the Monetary Control Act, all regular NOW accounts will effectively become Super NOW accounts. Super NOW accounts will overnight represent a much higher percentage of the funds in M1. Accordingly, controllability of M1 and volatility of interest rates would become that much more sensitive to the Barnard-Heinz provisions.

The remaining deposit components of M1, namely, demand deposits and non-NOW other checkables, would remain unaffected, however, still subject to rate ceilings or prohibitions on explicit interest and still subject to noninterest-bearing reserve requirements.

²⁵ The discussion in the text has focused on the potential effects of payment of interest on reserves on the money demand curve. Presumably, paying interest on reserves could also have an effect on the money supply curve, either by altering the stability of excess reserves or borrowings behavior or by altering their interest sensitivity. More so than potential money demand effects, however, potential money supply effects are difficult to determine.

What would happen if at some point these restrictions were removed as well? That is, what would be the implications of moving beyond the Barnard-Heinz world and into a world where interest were paid on the reserves behind *all* deposits?

Not surprisingly, matters would become even more complicated. Several key issues would come to the fore, among them the selection of a specific payment rule, the determination of an appropriate benchmark market rate, and the accurate measurement of involuntary reserves.

Consider first the selection of a specific payment rule. Depending on what type of rule was employed, the money demand curve could become highly interest inelastic, posing major difficulties for monetary targeting. For example, some authors have argued that if interest were paid at a rate that was always a given level (a constant spread) below the market rate, under certain conditions the wedge between market rates and the rate paid on money would become completely insensitive to changes in market rates. As a result, the demand for money would become completely interest inelastic.²⁶

A completely inelastic money demand function would pose major problems for monetary control. In such a world, the demand for money could be influenced only through changes in income, not through changes in interest rates. Controlling the money supply through changes in income would make little sense, however, given that money was intended to be an intermediate target for income. That is, policymakers would find

²⁶ See David E. Lindsey, "The Implications of Removing the Demand Deposit Rate Prohibition for Monetary Control and the Conduct of Monetary Policy," Special Studies Paper No. 104, Division of Research and Statistics, Federal Reserve Board, February 10, 1978, especially pp. 11-12, and Richard G. Davis, "Monetary Targeting....," pp. 33-40.

themselves in the incongruous position of trying to control income by controlling the money stock, which in turn could only be controlled by income. Monetary targeting would cease to be a useful policy strategy.

Other payment rules could be devised that would leave some interest sensitivity in money demand. But this worst case scenario does illustrate vividly the stakes involved in moving beyond the Barnard-Heinz bills.^{27,28}

A second issue that would take on added importance in a world of universal payment of interest on reserves would be the determination of an appropriate benchmark market interest rate. Assuming that a market-related payment rule were chosen, one would still be left with the question, which market rate should the rate paid on reserves be tied to? Depending on what market rate was used, depository institutions might have an incentive to alter their behavior, complicating monetary policy.

Suppose, for example, that “the” market rate was taken to be the rate earned on the Federal Reserve’s security portfolio and that the rule was to pay exactly this rate. Since the Federal Reserve’s portfolio typically contains

some long-term bonds, depository institutions might be expected to bid aggressively for reserves when short-term rates were falling relative to long-term rates. That is, they might take actions to acquire more reservable deposits because the interest being paid on the reserves backing these deposits would be more attractive relative to alternative short-term assets.²⁹ The opposite reaction might be expected when short-term rates were rising. Similar complications could arise with respect to the timing of “the” market rate. Paying a lagged market rate on reserves, for example, could induce aggressive bidding for reserves when interest rates were falling. When rates were rising, on the other hand, institutions would have less incentive to hold reserves. As an interest-bearing asset, reserve holdings would be more sensitive to market forces, potentially causing more disruptive shifts in the money supply curve.

A third issue that would come to the fore would be the accurate measurement of involuntary reserves. To remove the reserve tax, interest should be paid only on involuntary reserves. Inadvertent payment of interest on voluntary reserves would have the effect of subsidizing depository institutions and their customers; instead of having competitive parity with nondepository institutions, depository institutions would have an advantage. But accurate measurement of involuntary reserves is not straightforward. For example, are all reserve balances at Federal Reserve banks involuntary reserves, as implicitly assumed in the Barnard-Heinz bills and elsewhere in this article? Or would depository institutions elect to hold some of these balances anyway, in

²⁷ The worst case scenario also implicitly assumes away currency holdings. As a nonreservable component of M1, currency would be unaffected by payment of interest on reserves and would thus remain sensitive to changes in market interest rates. The demand for M1 as a whole, then, would retain at least some interest sensitivity. Whether the magnitude of this responsiveness would be sufficient to warrant continued adherence to monetary targeting, however, is questionable.

²⁸ The payment rule issue was largely sidestepped in our discussion of the monetary control implications of the Barnard-Heinz bills because of the limited nature of those proposals. The bills would affect only one component of M1, namely, Super NOW accounts; regardless of how interest was paid on Super NOW reserves, the demand for all other components of M1 would remain interest sensitive, and hence, the demand for M1 as a whole would retain some measure of interest sensitivity. The magnitude of this overall sensitivity, of course, would depend in part on how much sensitivity remained in Super NOW demand, which in turn, would depend on the particular payment rule employed.

²⁹ Robert Laurent and Larry Mote make a similar point in “Some Neglected Problems in Paying Interest on Reserves” (unpublished Federal Reserve Bank of Chicago manuscript), noting that paying too high a rate on reserves would result in depository institutions being subsidized.

part, perhaps to clear checks? Conversely, does all vault cash necessarily represent voluntary reserves? Such questions would need to be answered if the reserve tax were to be accurately offset.

Summary

Some movement toward payment of interest on reserves appears likely in the years ahead. Although this would not be the first time that such interest was paid in the United States, it would represent a significant departure from conditions today. At present, no depository institution is permitted to hold interest-bearing reserves.

Interest-bearing reserves would enhance overall efficiency and equity. Because the reserve tax that is presently imposed on depository institutions and their customers would effectively be lifted, depository institutions would be better able to compete with nondepository institutions. This heightened competition would presumably lead to a more efficient allocation of financial resources. At the same

time, overall equity would be enhanced as the once-narrow reserve tax was shifted to the population at large.

Interest-bearing reserves would also have an effect on monetary policy. Payment of interest on the limited basis proposed in recent bills (in which interest would be paid only on the reserves held against Super NOW accounts and nonpersonal MMDA's) would very likely introduce short-run transitional problems for

It would appear prudent to proceed cautiously and slowly in moving toward payment of interest on reserves.

monetary control. The potential long-run effects of these bills are more far reaching, but their net impact is difficult to predict. Moving beyond these bills and paying interest on all reserves would complicate matters even more. Given the complexities and potential problems implied for monetary policy, it would appear prudent to proceed cautiously and slowly in moving toward payment of interest on reserves.



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