FEDERAL RESERVE BANK OF ST. LOUIS

DECEMBER 1969

REVIEW

CONTENTS

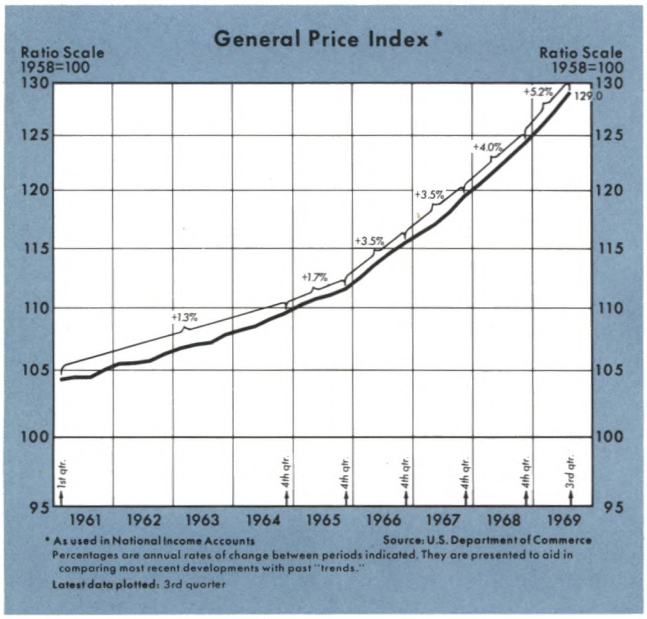
Vol. 51, No. 12

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

1969—Battle Against Inflation

by NORMAN N. BOWSHER

NINETEEN SIXTY-NINE has been the fifth year of intensifying inflation. Overall prices, after remaining fairly stable in the early Sixties, rose 1.7 per cent during 1965, 3.5 per cent a year in 1966 and 1967, 4.0 per cent during 1968, and an estimated 5 per cent in 1969. Not since World War II has the American economy experienced such a sustained price upsurge.



Inflation has been the nation's most serious domestic economic problem in recent years. The extent of concern over this problem has been evident from the numerous tough decisions the public authorities have made in an attempt to moderate it. Tax rates were raised, growth in Government spending was reduced, and monetary growth was restrained. Despite these actions there is as yet no firm evidence that the rise in prices has decelerated, or that inflationary expectations have moderated.

Some believe that inflation has now become inevitable, and that the country should learn to live with it. They feel that inflation has some desirable features, and that even if undesirable on balance, the nation apparently cannot stop it, or the costs of doing so are likely to exceed the benefits. At the other extreme, some feel that inflation is intolerable, and that it must be stopped even though the necessary cost is likely to be a severe and prolonged recession. The majority of experts are neither complacent about inflation, nor so pessimistic about its cure. Although stopping inflation is generally believed to involve hardships, it is felt that the necessary transition costs of following proper public policies would not be great compared with the inequities and inefficiencies resulting from continued reductions in the purchasing power of the dollar.

This article traces the course of the inflation of the past five years. It sets forth some of the chief causes and effects, reviews the actions taken to resist inflation, presents an analysis of economic developments during 1969, and provides some observations on the outlook.

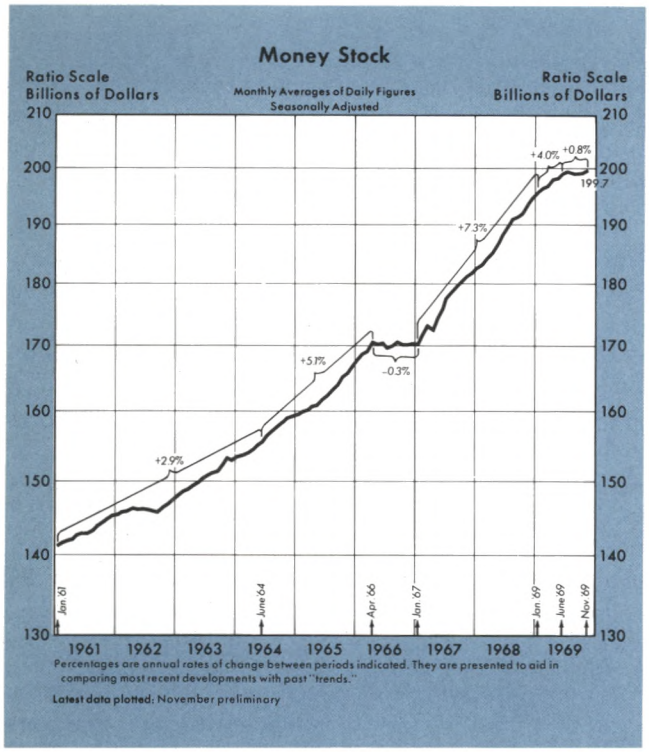
Balanced Economic Expansion — 1961 through 1964

Following the recession of 1960, the country experienced four years of pronounced economic expansion with little inflationary pressure. Real output of goods and services increased at a 5.4 per cent annual rate from early 1961 to late 1964. Except for a pause in late 1962, this was a period of steady economic expansion.

In the early Sixties real growth was faster than the estimated 4 per cent rate of growth in productive potential. As a result, unemployment was reduced from about 7 per cent of the labor force in early 1961 to less than 5 per cent in late 1964, and manufacturing plant utilization rose from 75 per cent to 86 per cent of normal capacity. These gains were accomplished in an orderly fashion without great frictions, shortages, or imbalances, while average prices remained relatively steady. Overall prices, measured by the GNP deflator, rose at a 1.3 per cent annual rate. However, because of the difficulty of fully taking account of changes in discounts granted and quality improvements, the index probably overstated the actual price increase.

The economy demonstrated a great resiliency and ability to expand in the 1961 to 1964 period. Fiscal and monetary management caused no great shocks to the economy, and the free enterprise system responded admirably. The nation's money stock grew at a 2.7 per cent annual rate from mid-1960 to mid-

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



1964, faster than the average 2 per cent rate of the previous decade, but slower than the estimated 4 per cent rate of growth in productive capacity. During the early Sixties policymakers faced two major economic problems which apparently called for opposite courses, probably accounting for a compromise between moderate and relatively steady growth in money. Unused resources were a signal for monetary expansion while an adverse balance of payments and gold outflows called for restraint. Since the demand for money to hold was probably increasing less rapidly than either real production or productive potential, it was appropriate that money expand less rapidly than either of these magnitudes in order to avoid inordinate inflation.

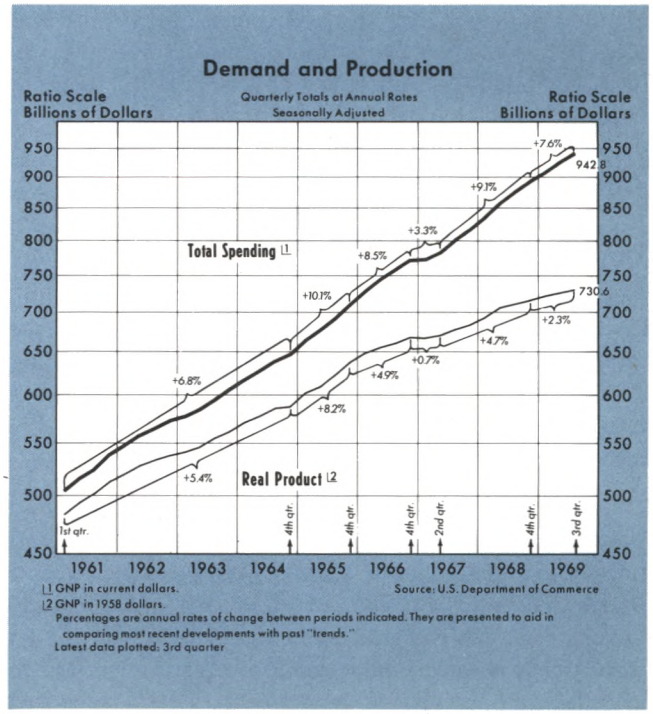
The influence of the Federal budget on total spending, as commonly measured, was moderate from 1960 to early 1964. The growth rate of Government spending and the net surplus or deficit of both the high employment and the national income accounts budgets remained in fairly narrow ranges. Despite the strong and balanced economic expansion without excesses during the early Sixties, some policy advisers held theories which indicated that the state of the budget was highly depressing to total spending, production, and employment. After a substantial delay, taxes were cut in early 1964, with the objective of keeping the country moving by eliminating the alleged actual or potential "fiscal drag."

Excessive Spending and Inflation — 1965 through 1969

Since 1964 total spending for goods and services has risen much faster than the country's potential to supply them. Total outlays rose at an average 8 per cent annual rate from late 1964 to late 1969. With little excess capacity, increases in real output were constrained by the growth in the nation's capacity to produce. The rise in spending was roughly double the estimated rate of expansion in potential output, given the growth in the labor force, capital equipment and technology.

Most sectors of the economy have participated in the rapid increase in spending which began in late 1964. Government purchases of military goods have expanded at an 11 per cent annual rate since 1964, compared with a trend rate of 2 per cent from 1957 to 1964. Other Federal Government expenditures have also increased at an 11 per cent rate since late 1964. Business investment has risen at an 8 per cent rate since late 1964, after increasing at a 5 per cent rate from 1957 to 1964. Personal consumption expenditures have increased at a 7.6 per cent rate since late 1964, following a 5 per cent rate of increase from 1957 to 1964.

With spending on goods and services rising faster than their production, prices were bid up. The rate of inflation appeared mild at first, reflecting inflexibility of some prices in the short run, the moderate amount



Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

of excessive demand, and fuller use of resources. Overall prices went up 1.7 per cent from late 1964 to late 1965. About one-sixth of the rise in total spending was reflected in higher prices while five-sixths went for additional goods and services.

As time passed, demand-pull intensified, and price increases accelerated. During both 1966 and 1967 prices rose 3.5 per cent, and in 1968 they rose 4 per cent. Only about half the total growth in spending during the 1966 through 1968 period went for additional real output; the other half was taken in higher prices. Effective prices may have risen even more than these figures indicate, for when demand becomes excessive, discounts and rebates are eliminated, surcharges abound, and there is a tendency to reduce quality standards. In the preparation of price indexes, some of these developments may have been missed, since producers are not likely to disclose their complete discount policies or a deterioration in product quality.

The inflation has been even more severe during 1969. The continued rise in total spending in excess of production, prompted in part by deterioration of the illusion that money has a relatively constant value, has contributed to the greater price increases. Overall prices have gone up about 5 per cent in the past year, even though there has been a little moderation of growth in total spending. As a result, nearly three-fourths of the rise in outlays has been used to pay higher prices. Growth in real production declined to about 2 per cent in 1969, or to about half the trend rate. In recent months the rise in prices probably has been at about the same pace as the rise in spending, with little net change in total real output.

Causes of Excessive Spending and Inflation

In our free enterprise system each spending unit – household, business firm, or governmental unit – determines whether to spend or save the funds available to it. Hence, one might conclude that the excessive total spending resulted from an unfortunate bunching of expansive individual decisions. Such a conclusion is only a half-truth, providing little insight into the basic forces determining total spending.

Consumer spending is closely related to income, and business outlays are generally related to expected profits. Although these sectors account for a major portion of total spending, and changes in them do have considerable affects on total spending, they alone have seldom been the prime motivating forces in bringing about cyclical movements in total spending

Two forces in the economy which are under the control of public policy and which are believed to have a great influence on private spending decisions are fiscal policy and monetary management. Most studies of economic stabilization have focused on them.

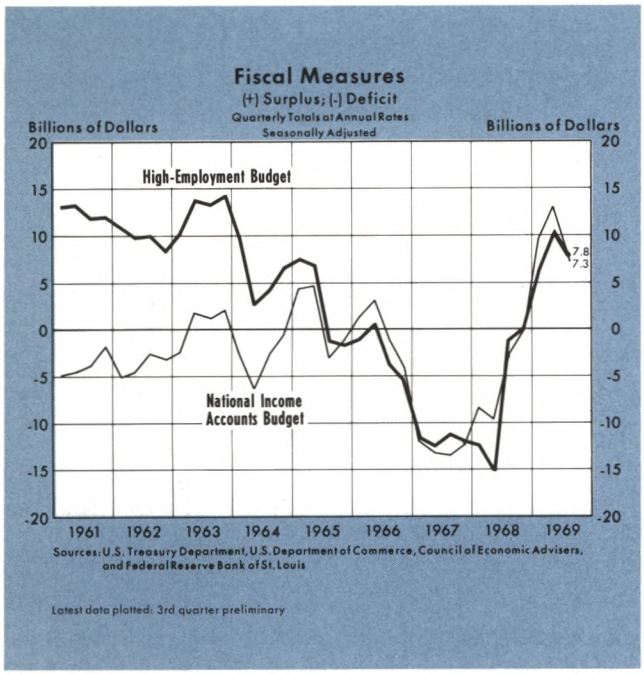
Fiscal Actions – The results of decisions by the Federal Government which change its spending and taxing programs are fiscal actions. It has commonly been believed that such changes expand or contract total public and private spending by some multiple. However, the aggregate influence of the Government on total spending is greatly diminished if the resulting deficits or surpluses are financed by the public out of planned saving rather than accompanied by changes in the money stock.[1] Changes in Government activities tend to be offset by opposite movements in private spending when the Government finances its deficits with debt paid for by the public out of current planned saving.

Among the commonly used measures of Government fiscal actions are the national income accounts budget, the expenditure component of this budget, and the high-employment variation of it. The national income accounts budget summarizes the receipts and expenditures of the Federal Government sector as an integral part of the national income accounts. The high-employment budget is an estimate of the expenditures and revenues in the Federal sector of the national income accounts at an assumed constant rate of growth of real economic activity (conventionally about 4 per cent unemployment). It attempts to abstract from the impact of actual economic activity on the realized surplus or deficit.

It is widely believed that the inflation since 1964 has been caused by Government fiscal mismanagement. Forthcoming defense spending was greatly underestimated, there was lack of restraint on non-defense outlays, and there was delay in raising taxes. As a result, from 1963 to mid-1968 the Government cut tax rates and increased growth rates in both defense and nondefense outlays. The high-employment budget, which was at a $13 billion surplus in 1963, declined to about a $14 billion annual rate of deficit in the first half of 1968. The national income accounts budget shifted from a small surplus in 1963 to a $9 billion deficit in the first half of 1968. From 1963 to

[1]Leonall Andersen and Jerry Jordan, "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization," this *Review*, November 1968, pp. 11-24; and Michael Keran, "Monetary and Fiscal Influences on Economic Activity – The Historical Evidence," this *Review*, November 1969, pp. 5-24.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



early 1968 national income accounts expenditures rose at a 10 per cent annual rate, after increasing at a 6 per cent rate from 1957 to 1963.

Monetary Actions – Another force under the control of public policymakers, which is believed to have a vital influence on private spending decisions, is monetary actions. The Federal Reserve, by determining the volume of Federal Reserve credit outstanding and thereby the amount of the monetary base and the reserves of the member banks, can manage the supply of money (demand deposits and currency) in the economy. By supplying more money than the public desires to hold, given current levels of income, wealth, and interest rates, the public's demand for other financial assets and for real goods and services is stimulated. Businesses and households undertake to exchange excess money balances for assets which will provide more satisfaction. Conversely, by providing less money than the public wishes to hold, the central bank can place downward pressure on the rate of spending, since businesses and individuals will reduce outlays in an attempt to build up cash balances in relation to other assets.

Monetary actions share responsibility for the overheating of the economy. From the end of 1964 to the end of 1968 the stock of money rose at an average 5 per cent annual rate. By comparison, money grew at about a 2 per cent rate from 1957 to 1964. By subperiods, from late 1964 to the spring of 1966 money rose at a rapid 6 per cent rate, remained on a plateau during the summer, fall and winter of 1966, and then rose at a 7.3 per cent rate until January 1969. The course of money reflected roughly parallel courses of Federal Reserve credit, the monetary base and member bank reserves.

Effects of Inflation

Inflation is a rise in the general level of prices or, otherwise stated, a decline in the purchasing power of the dollar, and tends to cause a redistribution of wealth and income.[2] It affects holders of money adversely, reduces the relative value of bonds, savings accounts, and other dollar-denominated assets, and gives a windfall to debtors. For a savings account drawing 5 per cent per year interest, while prices increase at a 6 per cent annual rate, the saver receives a net yield before taxes of minus one per cent, since when the saver receives his principal plus interest, the funds will buy less than his principal alone would have bought at the time the deposit was made. After-tax income is a yet greater net loss.

Inflation has different effects on various individuals and businesses, depending on types of assets and liabilities held and sources of income, which, in turn, may have been affected by the extent to which inflation has been anticipated. When inflation can be anticipated and provided for, types of asset and liability holdings may be adjusted and the rate of price increase built into contracts by cost-of-living or other escalators. If both borrower and lender expect a 5 per cent inflation, and funds are worth a real 4 per cent, the interest rate stated in the contract would be 9 per cent. Then, with the 5 per cent rate of inflation, neither party gains nor loses.[3] Hence, with greater inflationary expectations market interest rates are driven up to progressively higher levels.

Since there is much uncertainty about the future course of prices and all people are not capable of making contracts against contingencies, inflation causes a redistribution of wealth and income. Money is noninterest bearing, and so adjustments cannot be made for reduced purchasing power of money holdings. Many mortgages, pensions, bonds, and other long-term contracts cannot be changed until they mature. Persons with small savings have been especially disadvantaged by inflation.

---

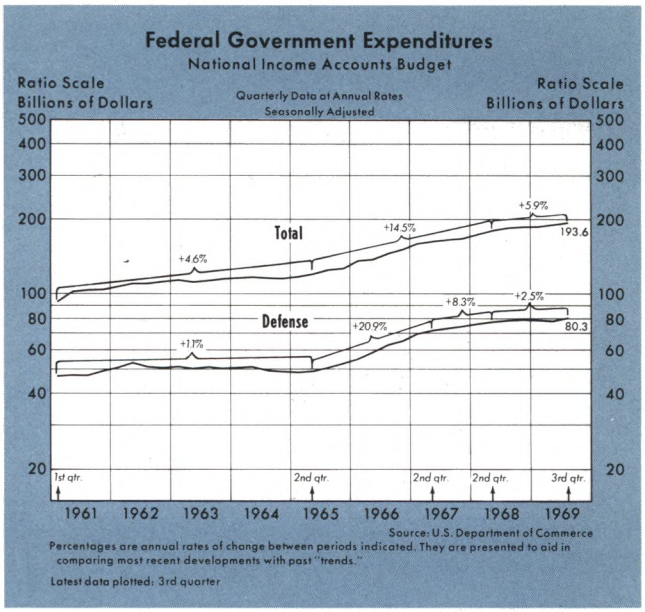
[2]See Albert E. Burger, "The Effects of Inflation (1960-68)," this *Review*, November 1969, pp. 25-36.

[3]Income tax considerations would make the stated rate even higher, since the borrower is able to deduct from his income the amount of interest paid, and the lender must include as income the greater amount of interest received.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Inflation has a tendency to cause inefficiencies and reduce output. For example, many find it advantageous to devote more effort to holding cash balances to a minimum. Because some prices are not completely flexible, shortages develop, causing inefficiencies in production. Uncertainties regarding the rate of inflation tend to encourage speculation.

The presumed benefits of inflation are dependent upon its continued acceleration and upon the losses of some to the benefit of others. Only if the rate of inflation were stabilized, with all the public fully anticipating it and acting upon the anticipations intelligently and costlessly, would the rate of inflation be immaterial. But, under present conditions of uncertainty, nonuniform expectations, and lack of flexibility, inflation is unjust, inefficient, and undesirable, and it is the stated policy of the Government to eliminate it.



Actions Taken to Resist Inflation

Because inflation is such a serious problem, the Government has regretted the policy errors which produced it, and taken a number of actions designed to resist or eliminate it. Unfortunately, many of these actions have been based on poor economic analysis, and they have proven to be largely ineffective, at least until very recently. Chief actions presumed and intended to be anti-inflationary have been raising tax rates, reducing the rate of increase of planned Government spending, regulating credit, permitting high interest rates, using moral suasion, and slowing the growth in money. Some have suggested that since these measures as yet have been largely ineffective in stopping price acceleration, the country should resort to a broad set of wage and price controls in order to govern prices.

Fiscal Actions — Because the rapid increase in the demand for goods and services and the resulting acceleration of price increases were thought to stem from expansionary fiscal actions, a serious step in resisting inflation was to reverse these actions. In fact, it was widely felt that the best, and perhaps only, way to reduce inflation was to raise taxes and reduce Government spending.

After long deliberations filled with assurances of potency of fiscal actions, the Revenue and Expenditure Control Act was passed and signed into law on June 28, 1968. The Act represented a significant move in fiscal policy for the express purpose of moderating growth of total demand, and thereby reducing inflation. The major features of the Act were reductions in some proposed spending and a 10 per cent surcharge on corporate and individual income taxes.

Reflecting the provisions of the Act and a few subsequent decisions made in the same spirit, growth in total Federal expenditures slowed sharply. In the last half of 1968 outlays in the national income accounts budget rose at an 8 per cent annual rate, and in the first three quarters of 1969 at only a 4 per cent rate, compared with a rapid 13 per cent per year pace from late 1964 to mid-1968.

The larger tax receipts, flowing from the surtax and the higher levels of the public's income, and the slower growth in Government spending led to an abrupt reversal in the Federal budgets. The national income accounts budget went from a $9 billion annual rate deficit in the first half of 1968 to a $10 billion rate surplus in the first three quarters of 1969. On a high-employment budget basis, the shift was from a rate of $14 billion deficit to an $8 billion surplus.

Despite the predominant feeling that a tax increase and some expenditure controls were necessary, many analysts in the late summer and fall of 1968 felt that the steps actually taken were too vigorous, and expressed a fear of overkill. Most econometric models of the economy indicated a quick and drastic slowdown in spending and inflation as a result of the fiscal actions. Arthur Okun, then the Chairman of the Council of Economic Advisers, summed up this opinion by stating, "I know of no one who would say now that our worries are still those of expanding too fast. If any-

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

thing, the balance has shifted a bit in the other direction."[4]

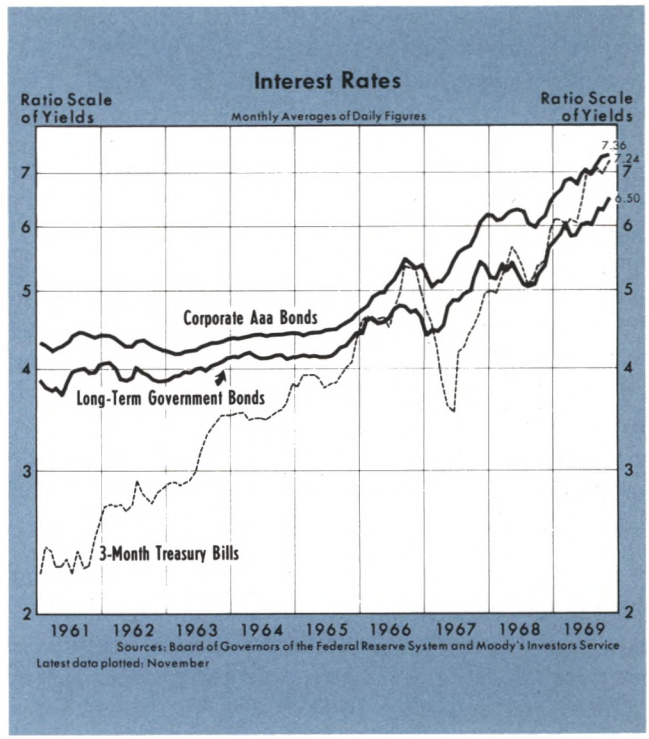
Responding to the marked shift in sentiment and expectations after the tax increase and the cut of planned Government spending, monetary policy was ostensibly relaxed. The directive to the System's operating manager on July 16, 1968, stated in part, "The new fiscal restraint measures are expected to contribute to a considerable moderation of the rate of advance in aggregate demands," and he was instructed to accommodate ". . . the tendency toward somewhat less firm conditions in the money market . . ."[5]

Not all early evaluations of the impact of the fiscal action agreed that the inflation would be stemmed by this action alone. For example, this bank's study of the effects of the fiscal program published in the August 1968 issue of this *Review* (pp. 3-6) concluded:

> Fiscal authorities have adopted a program of Federal budget restraint in an effort to combat excessive total demand. It is hoped that this action will moderate inflationary pressures while only slightly affecting output and employment. However, an inflationary psychology has become entrenched in the economy, as evidenced by large wage settlements and the rising costs of credit. If the Administration and Congress have finally assigned high priority to the task of reducing inflationary pressures, monetary actions to complement the fiscal program are needed.

The tax increase and the controls placed on Federal spending did not produce the results expected by their sponsors. Excessive growth in total demand continued at only a slightly reduced rate. Slower growth in spending by the Federal Government was largely offset by greater outlays by those who were able to attract the funds formerly flowing to the Government to finance its deficits. To some, fiscal action as a tool of economic stabilization became largely discredited by this experience, while the more devoted followers of this approach believe that the inflation would have been much worse without the higher tax rates and spending cuts, that the actions were not large relative to the size of either the economy or the inflation, and yet total spending growth stopped accelerating and slowed moderately after the action.

Interest Rates — Market interest rates have risen greatly since the early 1960's, but the increasing rates,



rather than limiting inflation, have been the result of excessive total spending and resulting inflation. Yields on highest grade seasoned corporate bonds, which averaged less than 4½ per cent in the first half of the 1960's, rose to 5.13 per cent in 1966, 5.51 per cent in 1967, 6.18 per cent in 1968 and over 7.30 per cent in the fall of 1969. Interest rates on other marketable securities also increased sharply.

Greater costs of credit, it was argued, should moderate inflation since higher rates make expansion of spending more difficult and are a stimulus to increased saving. The high interest rates have made it more costly for businessmen to purchase plant, equipment, and inventories. Higher rates have made it more expensive for consumers to buy homes, purchase automobiles, and obtain other durable goods. Yet, the excessive growth in aggregate spending has continued, placing more and more upward pressure on prices.

The higher interest rates have not stopped the inflation, but rather the inflation itself has been largely responsible for the rise in rates. Interest rates are a price for the use of funds, and as a price, they are affected by inflation. Price expectations, as indicated by recent actual price behavior, have been a major factor in the rise of market interest rates.[6] With expected inflation, saving is discouraged unless inter-

[4]"What's Ahead for Business," *U. S. News and World Report*, August 5, 1968, pp. 52-55.

[5]Federal Reserve *Bulletin*, October 1968, p. 866.

[6]"Interest Rates and Price Level Changes, 1952-1969," by William P. Yohe and Denis S. Karnosky on pp. 18-38 of this *Review*.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

est rates paid are high enough so that expected future real purchasing power of funds is protected, while borrowers offer higher rates since they expect that the prices of investment goods will increase.

The higher market rates in 1969 may have had no more stimulative effect on savers or restraining influence on investors than the lower market rates did in the early 1960's. In fact, recent rates paid on savings accounts have not even equalled the attrition in the purchasing power of the dollar, and many borrowers have anticipated that equipment and building costs would rise faster than the interest rate charged to finance purchases. Income tax considerations have also dulled the effectiveness of interest rates, since lenders must pay taxes on interest "earnings" and borrowers receive deductions for interest "expense."

Controlling Bank Credit – During 1969, the rate of growth of commercial bank loans and investments has been sharply reduced. In the first six months of the year outstanding bank credit rose at a 3.5 per cent annual rate, and since June has declined at about a 2 per cent rate. By comparison, this credit increased at an average 7 per cent rate from 1959 to 1966, and at an 11 per cent rate in 1967 and 1968. The reduction in the growth of bank credit has been brought about largely by regulating the maximum interest rate banks are allowed to pay on savings and other time deposits (Regulation Q). The marked slowing in time deposits and corresponding bank credit growth seems unlikely to have exercised any restraint on excessive total spending and inflation.

Regulation Q was instituted following bank failures of the early Thirties, primarily as a device to keep maverick banks from establishing rates clearly out of line with market conditions. However, in recent years as market rates have risen above Regulation Q ceilings, and most banks have found it increasingly difficult to compete for time deposit funds. Regulation Q apparently has been considered a tool for influencing total spending, on the grounds that a lower growth in time deposits causes a reduced growth in bank credit.

Largely because of limitations on interest rates they can pay on time deposits, banks have been drained of a substantial amount of time funds and have been unable to attract a normal flow. Large certificate of deposit obligations of commercial banks have fallen by more than half in the past year, from about $24 billion to about $11 billion. Growth in other time and savings deposits slowed from an 11 per cent annual rate from 1957 to 1968 to a 4.9 per cent rate in the first half of 1969 and to a 1.8 per cent rate of decline from June to November. With fewer funds flowing to them, banks have had less to lend or invest.

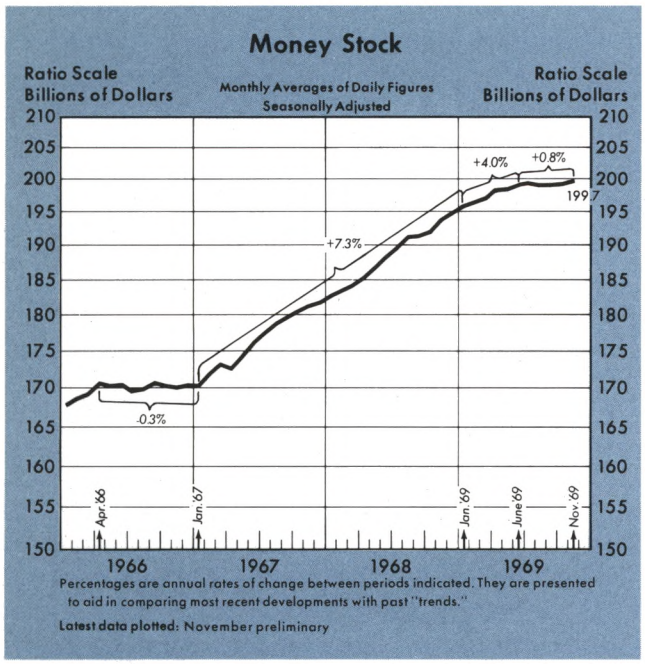
Regulation Q limitations, however, have had no demonstrable effect on the total amount of credit extended in the economy. Funds have failed to flow through commercial banks because they have been attracted to users through other channels, such as direct loans, commercial paper, and the Eurodollar market. By diverting loan funds through a second best route, the financial system has become less efficient. Other financial intermediaries subject to similar regulations have also been severely affected. Interest rate limitations have made it more difficult for home buyers and smaller businesses who must rely on local institutions to obtain credit. Larger businesses which can obtain funds in the central money markets have probably obtained funds cheaper and more readily than in the absence of disintermediation. Small savers have been penalized by the low rates received, while larger lenders who have more alternatives have received higher returns. Despite these inequities and disruptions to the financial system, it appears that growth in total credit granted (bank plus nonbank) was largely unaffected by the limitations placed on interest rates paid by financial intermediaries.

Moral Suasion – Another popular suggestion for resisting inflation, which is usually considered to be largely ineffective, is to ask the public to forego raising wages and prices. A set of guideposts was proposed by the President's Council of Economic Advisers in mid-January 1969: wages were to be raised no faster than average productivity growth (estimated at about 3 per cent a year), and prices were to be established so as not to raise profit margins.

However, the guideposts and other appeals to the public to use restraint in setting prices and wages have never been effective. Workers and businessmen cannot be expected to forego returns which are available to them. If they did, the economy would become less efficient; incentives would be dulled; shortages would quickly develop; and resources would not be attracted into areas of greatest demand.

Some have suggested that prices and wages should be rigidly controlled by law, with severe penalties for violations. Yet, attempts to control prices in the past indicate that such controls have been largely ineffective, because blackmarkets develop, quality deteriorates, and in other ways effective prices are raised.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



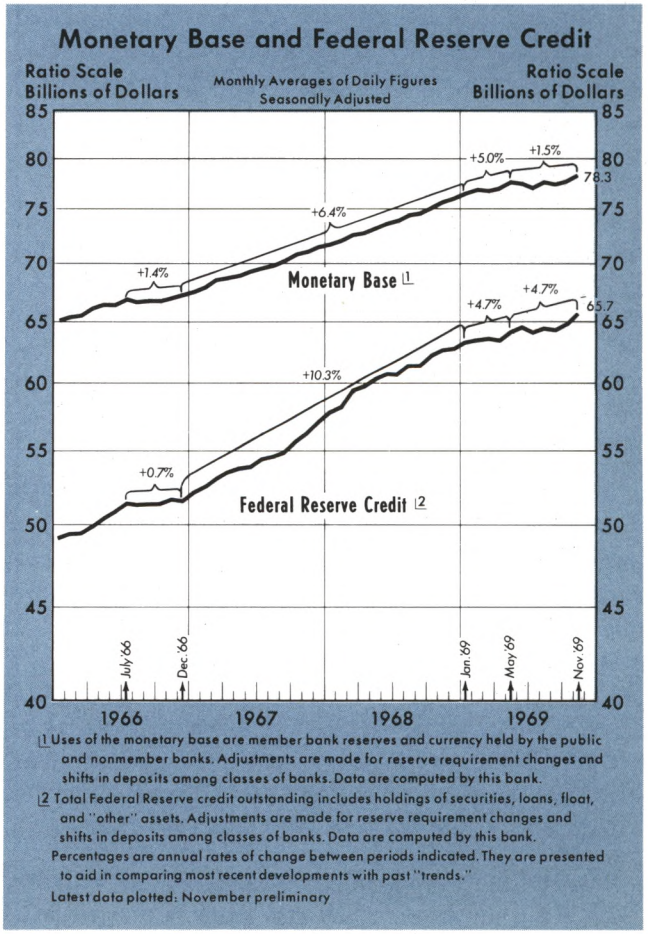
Controls are costly to administer, impinge on freedom, create shortages, and misallocate resources.[7] Controls interfere with the continuous price adjustments which are essential for equating supply and demand in the myriad sectors of the economy and attracting resources to the uses where they are most needed. Inflation may be "bad," but an inflation temporarily repressed by a broad set of arbitrary wage and price controls is worse. Unless controls are accompanied by policies which will reduce the excessive demand for goods and services, they provide no solution to inflation. If total spending is restrained, the controls are unnecessary.

Monetary Actions – Growth in the nation's money stock has slowed markedly in the past year. This action has already limited total spending, and studies of past lags of the effect of monetary restraint indicate that this action will be effective in further reducing demand for goods and services. Reducing the stock of money relative to the demand for it causes consumers and business to spend less than their incomes in an attempt to build up actual cash balances to desired levels.

During 1967 and 1968, the money stock rose at a very rapid 7 per cent annual rate. In the first half of 1969, growth in money slowed to a 4 per cent rate, and since June money has risen only slightly. By comparison, money rose at a 2 per cent trend rate from 1957 to 1964 when total spending was restrained. Most of the recent slowing of the money supply occurred in the demand deposit component. The currency component, which responds more to trends in spending than to current changes in member bank reserves, continued to rise rapidly in 1969.

The reduced rate of money stock growth during 1969 reflected a marked reduction in the rate of expansion in other monetary aggregates. Federal Reserve credit outstanding, which had risen at a 10 per cent rate during 1967 and 1968, slowed to about 5.5 per cent rate in the first five months of 1969 and to a 4.7 per cent rate after May. The monetary base after rising 6.5 per cent in both 1967 and 1968, increased at a 5.3 per cent rate in the first five months of this year, and has slowed to a 1.5 per cent rate since then. The deceleration in total member bank reserves growth was even sharper.

Continued growth in spending at an excessive rate during most of 1969 was consistent with the monetary actions of the past two years. Growth of the money stock was very rapid until early 1969, and the expansionary effects of such growth have usually been



[7] See "Controlling Inflation," a speech by Darryl R. Francis, President, Federal Reserve Bank of St. Louis, printed in the September 1969 issue of this *Review*, pp. 8-12.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

SELECTED MONETARY AGGREGATES
(Annual Rates of Change)

	Dec. 67 to Dec. 68	Dec. 68 to June 69	June 69 to Nov. 69 p.
Money Stock	7.2	4.4	0.8
Demand Deposits	7.1	3.7	—0.5
Currency	7.4	6.6	5.4
Money Plus Time Deposits	9.4	0.1	—4.0
Federal Reserve Credit	10.2	5.9	4.2
Monetary Base	6.5	4.0	2.3
Total Reserves	7.8	0.7	—5.9

p — Preliminary

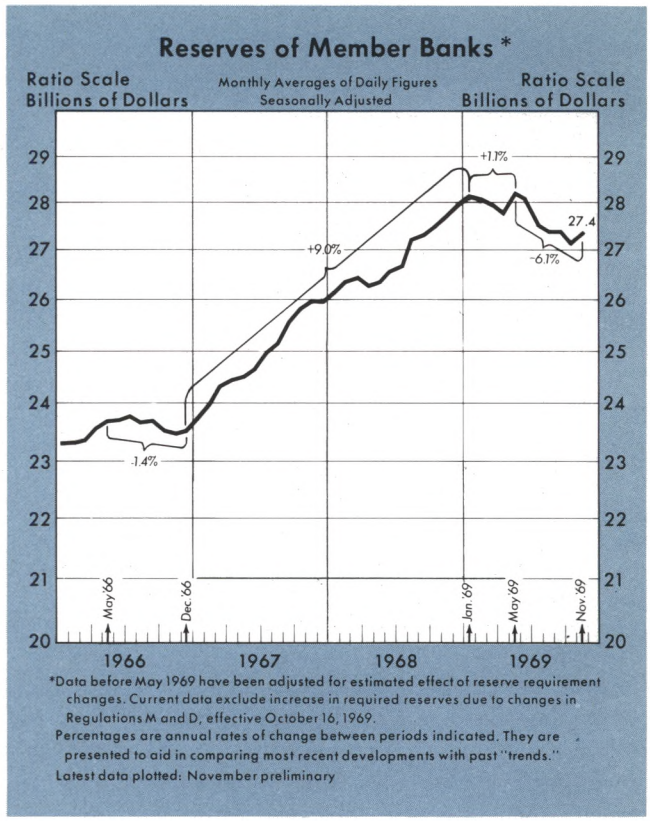
strongest after a lag of about two quarters. Hence, spending in the first half of 1969 was being affected primarily by earlier expansionary monetary developments. Then in the first half of 1969, money expansion, although dampened, continued at a rate in excess of the trend since 1957. As a result, one might have expected only a gradual moderation in the growth rate of spending during the summer and early fall. Since mid-year monetary restraint has intensified, and the initial major effects of this action would normally be expected to occur in late 1969 or early 1970.

Economic Developments in 1969

Despite the many actions taken in the battle against inflation, price increases accelerated in 1969. The greater inflation has been caused by both a continued strong demand-pull effect from excessive spending and a cost-push effect from previous excessive demands for goods and services. As the year progressed, however, there were increasing signs that the demand excesses were waning.

First Half — In the first half of 1969, growth in total spending continued to be excessive and moderated only slightly from a year earlier. Total spending on goods and services rose at a 7.4 per cent annual rate, down from the 9 per cent rate in the previous six quarters, but only a slightly less than the average 8 per cent rate that had prevailed since late 1964. Final sales (that is, total sales less changes in business inventories) rose at an 8.3 per cent rate in the first half of 1969, virtually the same as in the previous year and a half, and in the entire period since late 1964.

Growth in production, however, slowed in early 1969. Real output of goods and services rose at a 2.3

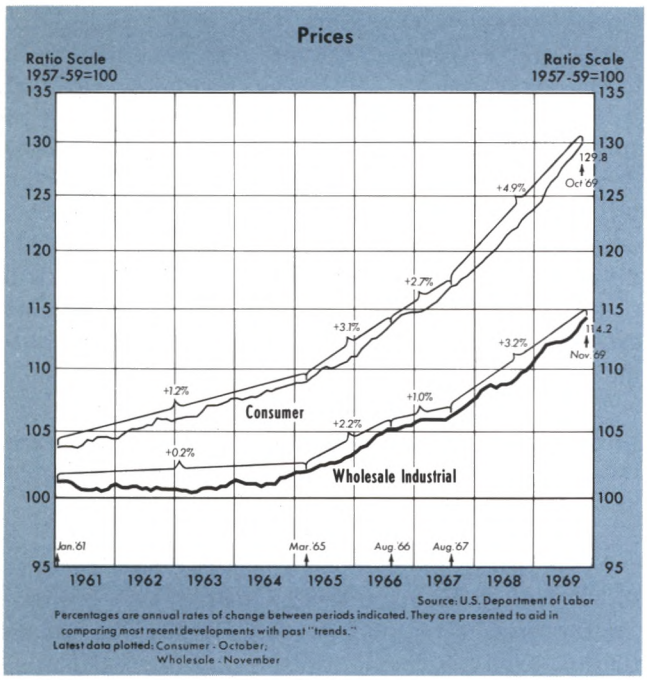


per cent annual rate during the first six months of 1969, about half the rate of the period from late 1964 to late 1968. Despite cutbacks in total output, both industrial production and employment continued to rise at rapid rates, and the level of unemployment remained unusually low. The upward trend in total production was probably restrained as the economy approached capacity and could not physically maintain the earlier growth pace. Growth of productivity slowed reflecting inefficiencies resulting from the inflation.

With spending continuing to rise rapidly and with production expanding at slower rate, the pace of inflation accelerated in early 1969. Overall prices went up at a 5 per cent annual rate in the first half of the year after rising 4 per cent in 1968 and 3.5 per cent in 1967. Consumer prices rose at a 6.4 per cent rate in the first half of 1969 compared with 4.7 per cent in 1968 and 3.1 per cent in 1967. Wholesale prices increased at a 6.3 per cent rate in the first half of 1969 following a 2.8 per cent rise in 1968 and a 0.8 per cent increase in 1967.

Second Half — Evidence of some real progress in combatting the economic ebullience was provided by a number of sensitive data series during the third quarter of 1969. Although the overall measure of

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



total spending expanded slightly faster than in the first half, analysis of spending by major categories indicated much less strength. Spending was supported by an unusually large catch-up Government pay raise in July. Nevertheless, final sales rose at only a 6.3 per cent annual rate, down from the 8.3 per cent rate in the first half. Total sales were bolstered by a substantial, probably largely unintended, buildup in inventories, as final sales apparently did not measure up to earlier expectations. An unplanned rise in business inventories while sales fall below expectations is frequently a sign of developing weakness in total demand.

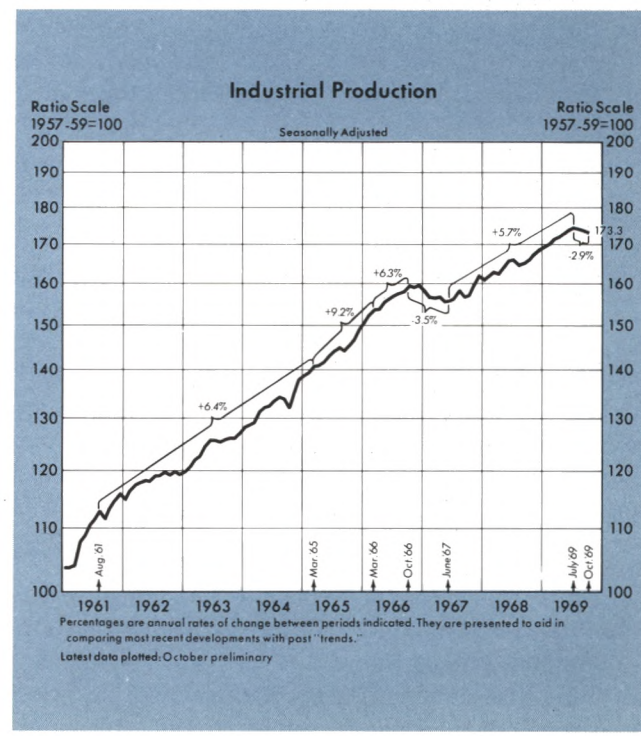
Real output of goods and services grew at a 2.2 per cent annual rate from the second to third quarter of 1969, about the same as in the first half. Other measures of performance, however, indicated weakness. Real final sales were about unchanged from the second to the third quarter after rising at a 3.3 per cent annual rate in the first quarter. Industrial production declined at a 5 per cent rate from July to November after rising at a 6 per cent annual rate from last December to July. Payroll employment rose at a 1.1 per cent annual rate from June to November, following a 4.2 per cent increase in the first half. Total civilian employment rose at a 1.6 per cent annual rate from August to November, after increasing at a 2.8 per cent rate in the first eight months of the year. Private nonfarm housing starts were at a 1.4 million rate from July to October, down from a 1.6 million rate in the first half.

Prices have risen since June at about the same pace as during the first half. The overall measure increased at a 5.4 per cent annual rate from the second to third quarter, up from a 5.1 per cent rate earlier in the year. Consumer prices rose at a 5.1 per cent annual rate from July to October, compared with a 5.9 per cent rate in the first seven months of the year. Wholesale prices increased at a slower pace from June to November, but the improvement provided little encouragement to those seeking to control inflation since it reflected a decline in farm prices resulting primarily from a jump in supplies.

Personal income grew at a 4.5 per cent annual rate from August to October after growing at an 8.8 per cent rate in the first eight months of the year. Business spending may have been moderated by rising inventories, declining corporate profits, and less optimistic expectations. Consumers found personal income rising at a slower rate after mid-summer, a development which, according to surveys, was accompanied by deterioration of consumer confidence. State and local governments have reduced the growth rate of their outlays in response to higher interest rates, in some cases to levels above ceilings permitted, and to public discontent with ever rising tax burdens.

Summary and Outlook

The past year has been the worst of five successive years of inflation. Overall prices have risen about 5



Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

per cent while consumer prices have increased 5.6 per cent. The inflation has caused a substantial redistribution of real wealth and income and has created inefficiencies.

The inflation has resulted from an unduly large demand for goods and services which was nurtured by expansive monetary developments in 1967 and 1968. In addition, prices have been forced up increasingly by cost-push forces resulting from the delayed effects of previous excesses. The rapid increases in spending and inflation have continued despite higher tax rates, cuts in Government spending programs, higher interest rates, a reduction in the growth of bank credit and exhortations by public officials for business and labor to use restraint in raising prices and wages.

The end of inflation is not clearly in sight. The recent record of economic advice and business forecasting has not been distinguished for its accuracy. A slowdown in activity and inflation widely predicted for the last half of 1968 and then for the first half of 1969 as a result of the restrictive policies adopted failed to materialize. This unimpressive record should engender caution, if not humility, for those who venture judgments as to current economic prospects.

Monetary actions continued very expansive through 1968, and projections based on these developments have not been misleading, except when based on short-run movements in preliminary data which were later revised. Monetary expansion was moderate in the first half of 1969, and since midyear the money stock has been virtually unchanged. Experience indicates that spending usually slows in about two quarters after a marked reduction in the growth rate of money.

After mid-1969, evidence began accumulating that the economic environment was changing, that the expansionary forces were weakening, and that a slackening in the quarter-to-quarter growth rate of spending was in prospect. It now (early December) appears that further reductions in the growth of total spending and production appear to be in prospect for early 1970 as a result of the monetary restraint in the summer and fall of 1969.

Even if growth of total spending continues to slow and is moderate in 1970, inflationary forces will probably remain serious throughout the year and perhaps for some time afterward. Expectations of rising prices are strong. Price increases usually continue for an extended period after growth in overall demand for goods and services moderates, reflecting cost-push forces generated by the earlier excessive spending. It took about seven years of restrained growth of spending in the 1950's to eliminate the inflationary pressures created during the Korean conflict. Some prices, such as negotiated wages and those set in other contracts, which have been relatively inflexible during recent periods of rapid price increase, will probably be adjusted upward later at time of renegotiation. Other prices have been held back by a money illusion, lack of knowledge of costs, public opinion, and inertia. As these wages and prices advance toward equilibrium levels, the increase in production costs will place upward pressure on other prices.

Nevertheless, the campaign against inflation seems to be yielding results in the last half of 1969, as inflationary pressures probably passed their peak in intensity. The results of great economic imbalances are likely to be felt more keenly in 1970 than they were in the late 1960's when they were generated. Assessment of economic prospects suggests that the country faces a very difficult period. Spending is likely to be sluggish, with corollaries of reduced production, rising unemployment, and a squeeze on business profits. At the same time significant deceleration of price increases may be dishearteningly slow. Success will require great perseverance which is more likely to be achieved if extreme erratic stabilization actions can be avoided.

The crucial consideration for stabilization policymakers in the coming year will be the determination of how rapidly the excessive growth of total spending can and should be reduced. Because of past errors, the choice now is to determine the lesser of evils. If monetary and fiscal actions are followed which will slow the rise in total demand for goods and services abruptly, inflationary pressures may be extinguished sooner than otherwise. However, the costs in terms of lower production, employment and incomes would be great, and the temptation would be strong to restimulate the economy before the task is completed as was the case in 1967. On the other hand, if demand grows so rapidly as to permit growth in production, employment and income to continue at near their long-run maximum trends, moderation of inflationary pressures may not be achieved and we are likely to have a continuation of the inefficiencies and inequities caused by a continuous erosion of the value of the dollar. A middle course is advisable.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Selective Credit — No Substitute for Monetary Restraint

A speech given by DARRYL R. FRANCIS, President, Federal Reserve Bank of St. Louis, at the 23rd Annual Conference of Bank Correspondents, First National Bank of St. Louis, November 13, 1969

THE USE of selective credit controls for economic stabilization is not of recent origin. The eligible paper provisions of the Federal Reserve Act passed in 1913 are a form of selective credit control. They provide for easier Federal Reserve Bank credit terms to borrowing member banks who offer short-term commercial paper as collateral. This provision implies that, if bank credit is limited to short-term commercial loans, monetary conditions will approach an optimum.

Selective credit controls were given a major boost in 1934 with the passage of the Securities Exchange Act, which delegated authority to the Board of Governors to control margin requirements (Regulations G, T and U) on securities traded on the major exchanges.[1] This control was provided for the purpose of preventing the "excessive" use of credit for purchasing or carrying securities. It was generally believed that a large volume of bank credit led to a major increase in stock prices and the ultimate collapse of the stock market in the late 1920's and early 1930's.[2] It was assumed that the expansion and contraction of stock market credit was a major factor contributing to the Great Depression of the 1930's.

Another boost to selective credit controls was provided by the passage in 1933 and 1935 of interest rate restrictions on demand and time deposits. Under authority granted by this legislation both member and nonmember banks were prohibited from paying interest on demand deposits. This legislation also authorized the Federal Reserve Board and the F.D.I.C. to limit the rates that banks could pay on time and savings deposits. At that time it was contended that these restrictions would tend to reduce the rates charged to bank customers, slow the movement of funds from smaller to larger communities where it was believed that they were used for "speculative" purposes, and prevent the excessive bidding up of rates, thereby reducing bank failures. More recently, time and savings deposit rate controls have been intended to reduce competition between banks and savings and loan associations, and thereby to speed the flow of funds into the housing market. This move away from free competition implies that it is better for the nation to have larger credit flows to the housing industry than to bank creditors, who may use the funds for plant and equipment expenditures and other purposes judged to be less worthy.

In 1941 the Board of Governors of the Federal Reserve System was authorized by an Executive Order of the President to restrict the use of credit for

[1] Securities Exchange Act, 1934, Federal Reserve Act as amended through Oct. 1, 1961, p. 222.

[2] See John J. Abele, "Black Tuesday, '29: Forgotten Lesson?" *New York Times*, Oct. 26, 1969 for a discussion of this view.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

consumer purchases (Regulation W). This was done by requiring a minimum down payment and a maximum time to maturity for such credits. The immediate reason for the restriction was to reduce the inflationary danger during the war by restricting the demand for consumer goods.[3] Actually, however, the legislation was associated with the thought that excessive consumer credit in the 1920's had contributed to the 1929-33 depression.

Restrictions on real estate credit were imposed in 1950 as part of a program to check inflation after the start of Korean fighting (Regulation X). These restrictions followed the general pattern of consumer credit controls by requiring minimum down-payments and maximum maturities on new one- and two-family houses. Credit restrictions were later extended to other real estate.

As an indication of the wide interest in the use of selective credit for controlling inflation, *Time* magazine, in discussing the reluctance of the Administration to impose price controls, reported that "credit controls, which were last imposed on the U. S. during the Korean War, might work more selectively to restrain lending, and in turn, demand for some kinds of goods".[4] In recent testimony before a Senate subcommittee, the President of the National Association of Home Builders stated that "we are now convinced that some type of credit controls must be undertaken".[5]

Selective Credit Controls — Pros and Cons

The argument for selective credit controls rests primarily on the assumptions that restrictive monetary actions cause high interest rates, and that high interest rates have an unduly harsh impact on some sectors of the economy such as residential construction. Proponents of selective credit controls believe that the "undesirable" impact of aggregate monetary controls can be eliminated by controlling the volume of credit used for specific purposes.

The view that credit controls in a specific sector will have an impact on total credit outstanding and total demand for goods and services may be looked upon as a variant of the Income-Expenditure approach to economic activity. For example, if one viewed total economic activity as resulting from autonomous expenditures in each of the separate sectors of the economy, a variation of expenditures in any one sector would have an impact on total expenditures and total income. This is consistent with the fiscal view of economic stabilization, which asserts that an increase in Government spending on goods and services results in an increase in total expenditures and total income. However, I do not mean to imply that all proponents of fiscal stabilization would recommend the use of selective credit controls for stabilization purposes.

In contrast to the Income-Expenditure approach to economic activity, I hold to the view that the stock of money is a major influence on total demand and the course of spending. Preferences for specific goods and services determine amounts that consumers will spend in each sector. If specific credit controls or other nonmarket controls are applied in any one sector, I believe that any reductions achieved will be offset by higher expenditures for other goods and services.

Despite the merits attributed to selective credit controls, I believe that they are socially undesirable for the following reasons: they are useless in controlling inflation; most of the hardships attributed to general monetary restraint are actually caused by selective controls or self-imposed rigidities; they are difficult to enforce; they are biased in favor of the wealthier groups; to the extent that they reduce demand for particular goods and services, they also reduce national welfare; and they are a restriction on individual freedom.

Selective Credit Controls — No Substitute for Quantitative Controls

The argument that selective credit controls will restrain inflation is not consistent with the functioning of our monetary mechanism and the factors which determine total demand. With our fractional reserve system of banking, the volume of bank credit is strongly influenced by total reserves and the reserve ratio requirements. Within limits, total credit is determined by the Federal Reserve System simultaneously with the determination of bank reserves and the stock of money. With fixed reserve ratios, other monetary multipliers, and a given level of bank reserves, credit restrictions on some purchases are fully offset by credit expansion for other purchases. Thus the total stock of money or credit remains unchanged after application of the restrictions. Money created

---

[3]Charles R. Whittlesey, Arthur M. Freedman and Edward S. Herman, *Money and Banking: Analysis and Policy* (New York: Macmillan Co., 1963), p. 256.

[4]*Time*, Oct. 10, 1969, p. 87.

[5]U.S., Congress, Senate, Subcommittee on Financial Institutions of the Committee on Banking and Currency, Hearings on S-2499 and S-2577, 91st Congress, 1st session, September 9, 1969, p. 17.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

by one type of credit expansion is equal in quality to money created by another type of credit, and total demand is unchanged.

Even if one subscribes to the idea that monetary management exercises its influence primarily through the credit market rather than through the money stock, selective credit controls are not a solution to the problem of excess demand. Credit restrictions on some purchases will cause rising demand for uncontrolled goods and services. Prices for uncontrolled goods will rise faster and resources will, in turn, flow from the production of controlled to uncontrolled goods. Output will be enhanced in the uncontrolled sectors and reduced in the controlled sectors, but prices for all goods will continue up, assuming excessive credit and monetary expansion has been permitted.

The argument that quantitative controls are perverse and create undue hardships in some sectors implies that the judgment of the controller is superior to market decisions. To the extent that the controls work, the controller is essentially transferring to others his own values as to what the nation should produce and sell. I contend that the market place can determine with least welfare loss which goods and services should be produced at slower or accelerated rates as a result of stabilization actions. Consumer purchases of goods and services under aggregate monetary controls are determined by utility at the margin, thus providing greater welfare than purchases arbitrarily determined for specific products through selective credit restrictions. Furthermore, appropriate monetary policies will reduce the wide swings in demand of recent years. A reduced amplitude of demand fluctuations would eliminate the unevenness of the effect of controls on total money and credit.

Credit used for purchasing and carrying common stocks has been given major attention because of the widespread belief that stock market credit and stock prices tend to trigger major swings in economic activity. Proponents of this view contend that speculators, when borrowing to make stock purchases, bid up stock prices to excessive levels and the following sharp declines tend to produce recessions.

I believe that both the impact of credit on stock prices and the impact of stock prices on economic activity have been greatly overestimated. Much of the fluctuation in the stock prices can be traced to the unevenness of aggregate monetary controls. Stock prices may be influenced temporarily by the volume of credit extended for security purchases. Reverse causation, however, is more likely the case. In other words, movements in stock market credit are influenced by changes in stock prices. Statistical analysis tends to demonstrate this reverse causation.[6]

Causation likewise runs from economic activity to stock prices. Rather than being an important factor contributing to the Great Depression as some contend, the sharp decline in the stock market in the late Twenties and early Thirties was mainly the result of a decline in earnings and in earnings expectations. This outlook for earnings can be traced to a decline in demand for goods and services, which, in turn, can be traced to a sharp reduction in the stock of money.

Carrying the securities market analysis a step further, we can assume that business capital will expand according to profit incentives and the cost of capital to entrepreneurs. If margin restrictions restrain the opportunity for raising capital through security sales, business will likely resort to borrowing directly from financial institutions to meet capital demands. I can see little difference between making loans to corporations and making them on securities which represent ownership of corporations. Furthermore, like other credit restrictions, if margin requirements alter credit or monetary flows, they also reduce national welfare as indicated by individual expenditure preferences.

The Apparent Need for Selective Credit Controls — A Result of Other Restrictions

Most of the hardships attributed to general monetary restrictions by advocates of selective credit controls would disappear if other useless impediments to credit flows were eliminated. Quite often the alleged victims of financial market imperfections are actually the victims of other controls. First, let us look at the argument that restrictive monetary actions discriminate against residential construction. Recent studies indicate that relatively slow rates of monetary growth

[6]Statistical analysis of the Standard and Poors 425 Industrials and of the 500 Stocks gives better results for the hypothesis that changes in stock values cause changes in credit for stock purchases than the reverse-causation hypothesis. The hypotheses were tested by regressing first differences of monthly data (stock price indices and credit extended to margin customers by banks plus customers' net debit balances at member firms of the New York Stock Exchange) on current and three lagged periods. The time period used was February 1953 to July 1969. The response of credit to changes in stock values was positive and significant for the current plus the first and second lagged month for each index. In contrast, the hypothesis that stock market credit causes stock prices to rise gave positive and significant results only in the current period. The coefficients were negative in the first and second lagged month for both indices.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

do not cause excessive cutbacks in spending on homes. Conversely, all marked and sustained declines in housing starts began in periods of rapid monetary expansion after excessive demands for goods and services had driven up prices and interest rates. The sharp rises in costs and interest rates were the major factors in reducing housing demand, and the reduced flows of funds into housing during these periods of high interest rates can be traced in part to such market impediments as usury laws, interest rate ceilings, and other regulations on financial intermediaries. When market rates reached these imposed ceilings, funds were diverted to other uses where rates could move to market-determined levels.

An additional side effect of this diversion of credit from its normal flows through intermediaries is its bias against small savers and borrowers. Small savers are relatively unable to place their savings in funds and securities and are relatively limited to controlled rates. These rates are lower than market-determined rates and small savers are the losers. Similarly, small borrowers are limited to the use of financial agencies for credit, and when this credit dries up because of rate regulations, small borrowers are, for all practical purposes, banned from the credit market. In contrast, large borrowers can participate in the capital markets through either new common stock offerings or other securities.

Self-imposed rate restrictions by state and local governments and rate restrictions on public utilities likewise reduce their expenditures during periods of high market rates. Rather than serving to reduce interest costs, the restrictions simply serve to postpone the expenditures until supply and demand conditions for credit cause market rates to return to levels that these spending units are willing to pay.

Enforcement of Selective Credit Controls is Difficult

Selective credit controls are extremely difficult to enforce uniformly among all groups. Enforcement officials can apply restrictions on a basis of the collateral offered as security, on the borrower's declaration of intended use of proceeds, and on the indicated use of proceeds. None provides a sure test of the use of loan proceeds. If proceeds from loans are commingled with other income such as salaries, wages, commodity sales, or other funds, one cannot determine which funds were used for the various expenditures. For example, if an individual wants to use his salary, wages, or other sources of income to purchase securities, he may borrow funds to make home payments or provide for other living expenses. The borrowed funds are similar to the other funds and the destination of the respective funds is difficult to trace.

The collateral offered is likewise a poor indicator of how loan funds are used. Proceeds from loans on common stocks or real estate may be used for medical payments, to purchase automobiles, or for numerous other purposes having no connection with stocks or real estate.

Trade-ins are also a means of by-passing down-payment requirements of selective credit controls. With anything that can be considered a trade-in item, the prospective buyer and seller can get together and make a mutually satisfactory deal by setting up a fictitious down-payment which meets both legal and personal requirements.

Selective Credit Controls Biased in Favor of the Wealthy

Selective credit controls are biased in favor of wealthy groups and against those with limited assets. Real and financial assets can always be used as collateral for loans. From such proceeds down-payments on purchases of controlled items can be made unless each dollar can be traced to its ultimate use. Furthermore, those with assets for collateral can avoid instalment credit restrictions altogether by obtaining commercial credit and purchasing consumer items with the proceeds. In addition, those with wealth are also likely to have sufficient cash flows to mingle with borrowed funds to make fund-tracing almost impossible. Control officials cannot determine whether the borrowed money was used for down-payments on controlled items or whether other cash flows were used for such purchases.

On the other hand, those without assets are forced to use purchased items as collateral. Thus, to the extent that selective credit controls serve to retard demand in a particular sector of the economy, they are a boon to persons with assets, providing them with products at lower prices, while those without assets for collateral are frozen out of such markets until the necessary down-payments can be accumulated.

Selective Credit Controls Distort Resource Use and Reduce Welfare

Fortunately, most selective credit controls are not readily enforceable. To the extent that they reduce demand and production of goods and services in any

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

sector, they tend to reduce welfare. The welfare of an individual is maximized, other things being equal, when he can spend both proceeds from loans and funds from other sources without restrictions or impediments. Each expenditure then provides him with maximum satisfaction at the margin. On the other hand, the capricious use of restrictions to alter individual spending, either in the form of higher down-payments or shorter terms, requires consumers to make less desirable choices. Fewer goods and services are purchased in terms of their usefulness for the same level of expenditures. An economy operating under selective credit restrictions fails to produce an optimum amount of some goods and overproduces other goods, with a consequent loss in total welfare.

Selective Credit Controls Reduce Freedom

Equally as important as the economic considerations is the useless infringement of selective credit controls on freedom. We can easily moralize as did the Medieval rulers that the poor should stay out of debt or that someone should set limits on their loan terms in order to assure that their credit is used for "appropriate" purposes. It is my belief, however, that man is happier when subject to the market forces rather than to arbitrary decisions of one or a few individuals. Freedom did not come easily to mankind, but we tend to take it for granted. Yet, in most of the periods since man's early history, he has been forced to bow in both thought and action to harsh taskmasters. In my view, we should not take losses of freedom lightly, despite the fact that controls are imposed upon us only a fraction at a time.

Summary

The current inflation has brought to the forefront proposals for using selective credit controls to stabilize prices and prevent the allegedly perverse effects of aggregate monetary restraint. Despite the possibility that selective controls may reduce the volume of credit used for specific types of purchases, they do not achieve the announced stabilization goals of the controllers. They do not restrain total demand for goods and services. Dollars created by one type of bank credit have the same purchasing power and the same impact on demand as dollars created by another type of credit. It is the total amount of credit and money created that determines average prices for all goods and services. Actually, to the extent that selective controls cause misallocation of resources, they have an inflationary impact.

Selective credit controls are almost impossible to enforce with equal results among all groups of individuals and businesses. Their use imposes much greater credit restraint on the small borrower, who is without other assets for collateral or large cash flows which can serve to disguise the actual use made of borrowed funds.

To the extent that selective credit controls are effective in changing credit flows, they reduce total output of goods and services and national welfare. Furthermore, they are an infringement on freedom because they impose restraints on how one can utilize his credit resources.

Last but not least is the fact that selective credit controls tend to provide their own breeding grounds. One control must ultimately lead to another as market forces tend to bypass each new regulation. The proliferation of ceilings on time and savings deposits is a good example. First, the ceilings were established uniformly on all accounts. Then there was a "need" to segregate deposits by size because of major losses of larger deposits. Smaller depositors could be paid less under monopolistic pricing because of lack of alternative investment opportunities. Rates to small savers were seldom changed. They remain at levels insufficient to cover the rate of inflation. Permissible rates on the larger accounts were raised at intervals as market rates continued up. Observing an opportunity to capture funds, bank holding companies and bank affiliates began to issue savings-type instruments which were not covered by the regulations. Now controls have been proposed in this leakage area. These attempts to cover all bypasses are like the man who built a dam to curtail the normal flow of a stream and discovered a leak. He used his finger to plug the hole. As water backed up, however, other leaks occurred requiring more fingers. The process of leak springing and finger plugging continued until the builder ran out of fingers.

Inflations can be controlled, but not through the use of specific controls on arbitrarily selected goods or services. The solution to inflation lies in the adoption and maintenance of appropriate monetary policies, which attack the cause of inflation. It requires an appropriate rate of growth in the stock of money. We moved toward a reduced rate of monetary growth near the end of last year and a still slower rate last June. I am confident that these actions will soon reduce the excess demand which was created by overly rapid monetary expansion in 1967 and 1968.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Interest Rates and Price Level Changes, 1952-69*

by WILLIAM P. YOHE and DENIS S. KARNOSKY

Our economy has been experiencing an accelerating inflation during the past five years. At the same time, market interest rates have risen to extremely high levels. The causes of inflation are relatively well-known, but the reasons for high interest rates accompanying inflation are not. The following article investigates primarily this latter situation.

Inflation develops when, at a high level of resource utilization, total spending on final goods and services (GNP) rises at a rate faster than the rate at which productive potential grows. Such has been the case in this country since early 1965. Total spending has risen at an 8 per cent annual rate and real product at a 4.4 per cent rate. As a consequence, the overall price level has risen at a 3.6 per cent annual rate.

The major cause of the current inflation has been the stimulus to total spending provided by an excessive rate of expansion in the money stock. From early 1965 to the end of 1968, the money stock, on balance, grew at a 5.2 per cent annual rate, compared with a 2 per cent trend rate in the preceding decade.

Rapid growth in the money stock accompanied by high and rising market interest rates has appeared a paradox to many observers. According to modern Keynesian economic theory, an acceleration in the rate of monetary expansion will provide lower market interest rates. However, this apparent paradox can be explained by the economic theory developed by Irving Fisher around the turn of the century.

According to Fisher, nominal (observed) interest rates consist of two components — the "real" rate of interest, to which real saving and investment respond, and a premium based on expected changes in the price level. The following study uses this Fisherian analysis to quantify the effect of inflation on movements in interest rates from 1952 to 1969. The principal finding is that past price movements exert a major effect on nominal interest rates, with the effect largely manifested within two years. Consequently, most of the rise in market interest rates since 1965 can be attributed to the current inflation.

This finding has an important implication for market interest rates as an indicator of the thrust of monetary actions on economic activity. High market interest rates do not necessarily indicate monetary restraint. Instead, they most likely indicate excessive monetary ease, (as measured by rapid expansion of the money supply) which results in rapidly expanding total spending and eventually inflation.

William P. Yohe is currently a visiting scholar with this bank and is also Professor of Economics and Director of Graduate Studies in Economics at Duke University. He is the author of numerous publications, primarily in monetary economics. Denis S. Karnosky is an economist with the Federal Reserve Bank of St. Louis.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

IN SUMMARIZING his many years of work on the subject, Irving Fisher cited four empirical relationships between interest rates and price levels:[1]

(1) Interest rates tend to be "high" when prices are rising and "low" when prices are falling.

(2) Interest rate movements lag behind price level changes, which obscures the relationship between them.

(3) There is a marked correlation between interest rates and a weighted average of past price level changes, reflecting effects that are distributed over time.

(4) "High" interest rates accompany "high" prices, and "low" interest rates accompany "low" prices.

The first of these relationships derives from the fact that, if lenders and borrowers could perfectly foresee future price level movements, the former would hedge against changes in the real value of their loan principal by adding the percentage change in prices over the life of the loan to the interest charge; the latter, expecting money income to change in proportion to prices, would readily accept the higher rate.

Fisher attributed the second and third relationships to imperfect foresight about future prices and the resulting inclination to extrapolate past price changes into the future in order to adjust interest rates for expected changes in prices. He devised the concept of the "distributed lag" to explain the way information about the past affects expectations of the future.

Fisher thought the fourth relationship, frequently called the "Gibson paradox," was an accidental consequence of the other three.[2] What is paradoxical is that the theory prevalent in that period presumably led to the conclusion that interest rates must be low in order to stimulate sufficient investment spending for the price level to be high, while empirically this has not been observed.

The present study is an examination of the second and third of Fisher's propositions, making use of modern data sources and statistical techniques. There is, at present, a major controversy over (1) the advantages and disadvantages of using monetary aggregates as opposed to using interest rates as indicators of the effect of monetary policy actions on the economy, and (2) the adjustments, if any, which must be made to an indicator to "neutralize" it with respect to changes that are not directly the result of policy actions.[3] Previous studies of the effect of price level changes on interest rates, some of which will be reviewed below, have found the lags to be so long that recent price behavior could be ignored in evaluating changes in observed interest rates. In contrast, results will be presented here based on the 1952-69 period which indicate that the lags are very short, with most of the effect of price level changes on both long- and short-term interest rates occurring within two years. Interest rates adjusted to remove the apparent influence of price changes have sometimes moved contrary to movements in observed rates. Furthermore, price changes have had a greater effect on interest rates in the 1960's than in the 1950's, and indeed, price changes in the latter period account for nearly all of the movement in interest rates.

Previous Studies of Price Expectations (Fisher) Effects

Tests for Fisher effects have generally been based on two hypothesized relationships:

$$(1) \quad rm_t = \dot{P}^e_t + rr_t$$

$$(2) \quad \dot{P}^e_t = \sum_{i=o}^{n} w_i \dot{P}_{t-i}$$

The first equation states that the nominal interest rate (rn) prevailing at time t for a particular debt instrument is equal to the annual rate of change in prices ($\dot{P}^e$) expected at time t to occur over the life of the instrument plus its "real" rate of interest (rr).[4]

*The authors are grateful to Christopher T. Babb and H. A. Margolis for advice on the statistical problems of this study, to Shigeyuki Fukasawa and James B. Greene for making available the results of their unpublished studies, and especially to Keith Carlson, Michael Keran, Thomas Havrilesky, and Edward Kane for helpful suggestions on earlier drafts of this paper.

[1]Irving Fisher, *The Theory of Interest* (New York: Macmillan, 1930), p. 438. Fisher first discussed these relationships in *Appreciation and Interest* (New York: Macmillan, 1896), pp. 75 and 76.

[2]The term "Gibson paradox" was coined by J. M. Keynes in *A Treatise on Money*, Vol. II (London: Macmillan, 1930), pp. 198-208. A. H. Gibson had studied the high correlation between levels of interest rates and prices in England throughout the 19th and early 20th centuries. The phenomenon was earlier called the "Ricardo-Tooke conundrum," after the leading antagonists in the Currency School-Banking School controversy in England in the first half of the nineteenth century. For a concise exposition of the controversy, see Knut Wicksell, *Lectures on Political Economy*, Vol. II (London: Routledge and Kegan Paul, 1935), pp. 168-190.

[3]See, for example, Leonall Andersen, Michael Keran, and Emanuel Melichar, "The Influence of Economic Activity on the Money Stock," this *Review*, August 1969, and Patric H. Hendershott, *The Neutralized Money Stock* (Homewood, Illinois: R. D. Irwin, 1968).

[4]Fisher used "real" rate in the sense of "virtual" or "true" rate. Technically, he also included a third term, $rr_t\dot{P}^e_t$, on the right side of equation (1). This is the interest that would be earned on the price adjustment to the nominal rate. The term is ordinarily so small that it is customarily

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Equation (2) is an application of the theory of "adaptive expectations," "error-learning," or, alternatively, "extrapolative forecasting." Faced with uncertainty about the future, an economic decision-making unit is presumed to base its predictions about future price movements on a weighted average of current and past changes in prices. Thus, in equation (2) the rate of price change expected at time ($\dot{P}^e_t$) for some future period is the weighted sum of actual past price changes ($\dot{P}_{t-i}$), where the importance of each past change is reflected in the weight w_i, and where n indicates how many periods in the past are relevant in forming expectations.[5] The approach is "adaptive" in the sense that in each period expectations are adjusted (or forecasting errors are corrected) for actual price changes. The approach is "extrapolative" in that past changes are extended (extrapolated) into the future.

Substituting equation (2) into equation (1) yields the form of the equation that is usually estimated:

$$(3) \quad m_t = \sum_{i=o}^{n} w_i \dot{P}_{t-i} + r r_t$$

The unmeasurable price expectations are not explicitly considered, but instead it is assumed they can be approximated by the observable pattern of past changes in actual prices (or in some other variable that may be critical to the formation of expectations about prices).

Fisher assumed that the weights in equation (3) declined arithmetically as one goes backward in time. His procedure was first to posit a time interval over which the entire effect of price level changes would be reflected in a nominal interest rate series, for example, ten years. Ignoring the current period price change, he then computed for each year the weighted average of past price level changes, using a weight of nine for one year earlier, a weight of eight for two years back, and so forth. The weighted price changes divided by the sum of the weights ($9 + 8 + \ldots + 0$) yielded the weighted average of past rates of price change. Fisher then observed which of these weighted averages best correlated with the nominal interest rate.[6] The "best fit" would be obtained where the correlation was highest or where further lengthening of the interval would not add appreciably to the correlation.[7]

A useful statistic for comparing the results of many distributed lag studies is the mean (or average) lag, that is, the time that elapses until half of the effect of a change in the independent variable is reflected in the dependent variable.[8] Using annual and quarterly data for the United States, Fisher found very long mean lags for the effect of price changes on long- and short-term interest rates. For example, the highest correlation between commercial paper rates and rates of change in the wholesale price index from 1915-27 was obtained when the latter was lagged over 120 quarters (30 years), implying a mean lag of about 40 quarters (10 years).

---

omitted. For the complete derivation of equation (1), see *Appreciation and Interest*, pp. 8-11, 66 and 67.

Some studies have also been concerned with the effect of changes in the rate of price change (i.e., price level accelerations) on changes (rather than levels) in interest rates. To see how this may be done, it is necessary to expand $\dot{P}^e_t$:

$$\dot{P}^e_t = \frac{dP^e_t}{P_t}$$

Substituting this term in equation (1), differentiating, and manipulating the result yields:

$$d(m_t) = \left(\frac{d^2P^e_t}{dP_t} - \frac{dP^e_t}{P_t} \right) \frac{dP_t}{P_t} + d(r r_t)$$

The term within the large parentheses represents price acceleration. See, *inter alia*, Allan H. Meltzer, "The Appropriate Indicators of Monetary Policy, Part I," *Savings and Residential Financing: 1969 Conference Proceedings* (Chicago: U.S. Savings and Loan League, 1969) p. 14.

[5]For a concise survey of the theoretical literature on adaptive expectations, see Zvi Griliches, "Distributed Lags: A Survey," *Econometrica*, January 1967, pp. 42-45.

[6]Within the framework of equation (3), Fisher calculated the correlation coefficient corresponding to the following regression equation:

$$m_t = \sum_{i=1}^{n} \frac{(n-i)}{n(n-1)/2} \dot{P}_{t-i} + r r_t + u_t$$

where $n(n-1)/2$ is the sum of n terms ranging from zero to $(n-1)$.

[7]His procedure was directly related to the present-day practice of choosing an estimated equation with the highest R^2 (coefficient of determination or square of the correlation ratio).

[8]The mean lag is simply the weighted-average lag, where the coefficients [w_i's in equations (2) and (3)] are used for the weights. When all of the weights are positive, the formula for the mean lag is as follows (Griliches, p. 31):

$$\frac{\sum_{i=o}^{n} i \cdot w_i}{\sum_{i=o}^{n} w_i}$$

that is, a weighted sum divided by the sum of the weights. In Fisher's calculations, the denominator is unity (his weights necessarily sum to one), so the formula for his mean lags is

$$\sum_{i=1}^{n} \left(i \cdot \frac{n-i}{n(n-1)/2} \right)$$

which simplifies to $(n-1)/3$. Fisher estimated his mean lags as $n/3$.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

In recent years there has been a considerable revival of interest in the study of Fisher effects, ostensibly the result of the reappearance of substantial variability in interest rates and price levels and methodological developments in the estimation of distributed lags. Two studies have attempted to measure "real" rates directly and then to relate the spread between various nominal rates and the estimated "real" rates to historical time series for price level changes, with inconclusive results.[9]

Most of the published studies have regressed nominal rates directly on current and past rates of price changes (or changes in nominal rates on price accelerations).[10] Data intervals have ranged from quarters (Gibson) to business cycle phases (Friedman and Schwartz). The time span has ranged from as early as 1873 to as late as 1966. Lagged rates of change in various price level indexes and even nominal income (Gibson) have been tried as indicators of price expectations. The forms of the distributed lags estimated have generally been either "unconstrained" lags or "geometrically decaying" lags.[11] Without exception, the mean lags of interest rates behind price changes were found to be very long. For example, Friedman and Schwartz found mean lags for short-term rates of about ten years and for long-term rates of 25 to 30 years, which they attributed to the "slow and gradual adjustment of anticipations of price changes to the actual behavior of prices."[12]

A Search for Fisher Effects

This study is based upon earlier work but departs from previous studies in ways that appear to have significant effects on the results, in particular:

(1) Monthly, instead of exclusively quarterly or annual, data are used for short-term and long-term interest rates (dependent variables) and for price level changes and other independent variables. Further, the interest rate series have been seasonally adjusted.

(2) A variety of kinds of distributed lags are estimated, in order to investigate the effect of lag form on the length of the lags.

(3) The monthly data are aggregated into quarterly and annual series to determine the effect of aggregation over time on the lag estimates.

(4) The study is purposely confined to the period following the Treasury-Federal Reserve Accord of 1951 in order to avoid having to contend with the constraint on interest rate movements imposed by the Federal Reserve's "par pegging" of Government securities prices. Further, the 1952-69 period is divided into two sub-periods to see whether there has been any apparent change in the mechanism relating past price changes to the formation of price expectations and any clues to the reasons for earlier findings of very long lags.

(5) A model will also be tested to see what happens to the explanatory power of past price level changes when variables assumed to affect "real" rates of interest are added to the regressions.

(6) Experimental "real" rate series will be generated and their movements compared with nominal rates to see whether there have been times when nominal rate movements might have been misleading indicators of changes in "real" interest costs.

Seasonal Movements in Interest Rates

A number of economists have observed not only seasonal movements in monthly and quarterly interest rate series, but also the influence on the seasonal

[9]Suraj B. Gupta, "Expected Rate of Change in Prices and Rates of Interest" (unpublished dissertation, University of Chicago, 1964), and Phillip Cagan, *Determinants and Effects of Changes in the Stock of Money, 1875-1960* (New York: National Bureau of Economic Research, 1965), pp. 305-309. Gupta's work is summarized and his empirical work extended in William E. Gibson, "Effects of Money on Interest Rates," *Staff Economic Studies*, No. 43, Board of Governors of the Federal Reserve System, March 1968, pp. 45-48 and 88-89. Preliminary work along similar lines was reported in David Meiselman, "Bond Yields and the Price Level: The Gibson Paradox Regained," in Deane Carson (ed.), *Banking and Monetary Studies* (Homewood, Illinois: R. D. Irwin, 1963), pp. 119-122.

[10]Meiselman, pp. 112-133; Milton Friedman and Anna Jacobson Schwartz, "Trends in Money, Income, and Prices, 1867-1966" (unpublished manuscript, National Bureau of Economic Research, November 1966), chapter 2, pp. 110-143; and Gibson, pp. 44-66 and supplementary tables. In their multiple regression study, Michael J. Hamburger and William L. Silber ("An Empirical Study of Interest Rate Determination," *Review of Economics and Statistics*, August 1969, pp. 369-373) rejected the rate of change in prices as insignificant.

[11]Both forms will be discussed later. To estimate unconstrained lags, one merely regresses the current value of the dependent variable on the current and a predetermined number of lagged values of the independent variable – there is thus no *a priori* constraint on the time shape of the coefficients. Geometrically decaying lags impose a geometrical decay on the coefficients, that is, part of each coefficient is a constant decay term less than one which, when raised to higher powers as the lag recedes into the past, decays (asymptotically approaches zero). See Griliches, pp. 16-49, and Lawrence R. Klein, "The Estimation of Distributed Lags," *Econometrica*, October 1958, pp. 553-565.

[12]Friedman and Schwartz, chapter 2, p. 139. Gupta, estimating geometrically distributed lags for the nominal rate – "real" rate spread behind price changes, found a mean lag of 16 years for long-term rates. Gibson estimated unconstrained lags for relatively short lag intervals (ten quarters and four years), so it is not possible to calculate mean lags for the total effect of price changes on interest rates. In Meiselman's study, the geometric decay coefficients came out very close to one, implying a long mean lag (nearly twenty years, for example, with a decay coefficient of 0.967, which he found in regressing bond yields on price changes over the 1873-1960 period).

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

of changes in Federal Reserve operating strategy for open market purchases and sales.[13] Since some of the data used for independent variables in the regressions were seasonally adjusted, it was advisable to seasonally adjust the short-term and long-term interest rate series, so that the results could be compared with those generated using unadjusted series.[14] As expected, stronger seasonals were detected in the short-term than in the long-term interest rates. The finding of pronounced seasonals in both for the 1952-60 period and the virtual elimination of seasonal movements for the 1961-65 period, probably the consequence of the Federal Reserve strategy to assist the balance of payments, confirms the conclusions of earlier studies. The resumption of pronounced seasonals is apparent in the calculations for the 1966 to mid-1969 period. The explanation may lie in the insertion of "proviso clauses" in the Federal Open Market Committee directives over the later period and the implementation of such directives by the Trading Desk at the Federal Reserve Bank of New York.[15]

Empirical Results — Interest Rates Regressed on Rates of Price Change

Data for the period 1952-69 were used to test the hypotheses about the effect of price expectations on the level of nominal interest rates. Several measures of both prices and interest rates were used in the estimation, and various lengths for the total lags were tested. In addition, several estimation techniques were employed. The results were very similar across the many combinations of data, length of the lag distribution, and estimation procedures, all suggesting a much shorter time horizon in formation of price expectations than had previously been found.

The interest rates used in this study are yields on securities issued by the private sector.[16] Short-term interest rates (rn^s) were approximately by the yield on four- to six-month commercial paper. The yield to maturity on Aaa-rated corporate bonds was used as the measure of long-term interest rates (rn^L). Price expectations were approximated by the rate of change of the consumer price index for all items, $\dot{P}^c$.[17]

Using monthly data for the period January 1952 to September 1969, the function

$$rn_t = a_0 + a_1\dot{P}^c_t + a_2\dot{P}^c_{t-1} + a_3\dot{P}^c_{t-2} + \text{---} + a_{n+1}\dot{P}^c_{t-n}$$

was estimated first by least squares regression of rn_t on current and lagged values of price changes for $n = 24$, 36 and 48 months. The coefficients of the regressions are presented in Chart I.

These regressions were run with both seasonally adjusted and nonseasonally adjusted interest rate series, and in each case the results using seasonally adjusted data traced quite closely those using unadjusted data. The introduction of the seasonal factor decreased the unexplained variance (increased the adjusted coefficient of determination, R^2) only slightly. Chart II presents the coefficients of the regressions:

$$rn^s_t = a_0 + a_1\dot{P}^c_t + a_2\dot{P}^c_{t-1} + \text{---} + a_{25}\dot{P}^c_{t-24}$$

$$rn^L_t = a_0 + a_1\dot{P}^c_t + a_2\dot{P}^c_{t-1} + \text{---} + a_{25}\dot{P}^c_{t-24}$$

The coefficients using seasonally adjusted interest rates are quite similar to those using unadjusted data.

[13]Leonall C. Andersen, "Seasonal Movements in Financial Variables – Impact of Federal Reserve and Treasury," *Business and Government Review*, University of Missouri, July-August 1965, pp. 19-26; "A Closer Look at Interest-Rate Relationships," *The Morgan Guaranty Survey*, April 1961, pp. 3-5; Gibson, pp. 30-32 and Tables 3 and 4; and Hamburger and Silber, pp. 370-371.

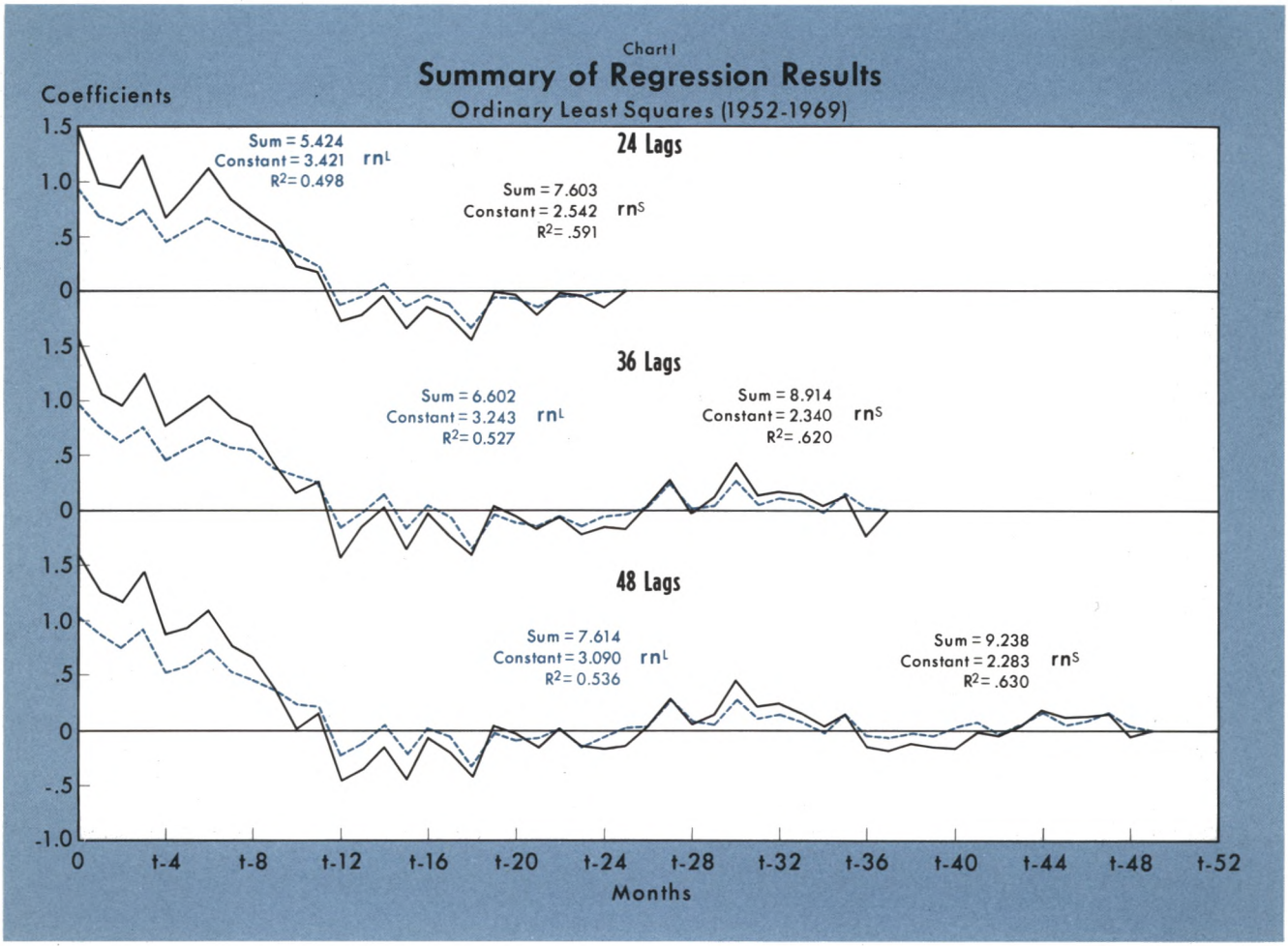
[14]Data have been seasonally adjusted using the X-11 Variant of the Census Method II Seasonal Adjustment Program, U. S. Department of Commerce, Bureau of the Census. *Source:* Board of Governors of the Federal Reserve System, Federal Reserve *Bulletin*.

[15]Jan Warren Duggar, "The Proviso Clause and Bank Credit Proxy" (unpublished manuscript, Federal Reserve Bank of New York, 1969).

[16]Since there are many factors in addition to price expectations that affect the level of interest rates, the dependent variable used in the regressions should be the one least influenced by those other factors. Yields on private securities were selected, instead of rates on Government debt, because they are more free of the direct influences of debt-management and monetary actions. However, Fukasawa obtained similar results using yields on Government securities. Greene found that price expectations were somewhat easier to identify using interest rates on private debt.

[17]Mortgage costs are included in the consumer price index and might contribute to some degree of spurious correlation between interest rates and price movements. Since mortgage interest rates tend to move with other nominal rates, using the consumer price index as the measure of price movements would tend to result in a positive bias in the observed relationship between interest rates and price movements. To test for this effect the consumer price index was purged of mortgage rate effects. Data on the mortgage component of the CPI were available from the Bureau of Labor Statistics only for the period 1954-64. Thus, nominal interest rates were regressed on the rate of change of the CPI and the adjusted CPI for this period only. The regressions using this adjusted $\dot{P}^c$ series were still quite close to those using the index inclusive of mortgage costs. Gibson's procedure of using changes in national income as a proxy for price expectations was also treated, using however, personal income, which is available on a monthly basis. The results, summarized in the appendix, were quite similar to those using the consumer price index.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



Since this close relationship was observed in all of the tests, only the results using unadjusted data will be explicitly considered.

The regressions show that price movements accounted for about 50 per cent of the variance in interest rates between 1952 and late 1969. The pattern of coefficients is consistent with the adaptive expectations hypothesis, that is, they are generally declining. The presence of small negative coefficients in the "tails" of the distributions could be explained theoretically by the eventual domination of positive "extrapolative effects" by negative "regressive effects" (see page 32 below). Although the t-test is suspect in dealing with a distributed lag regression,[18] the coefficients tend to be small beyond t-24 months and generally insignificant. Increasing the length of the lag from 24 to 48 months had little effect on the distribution of coefficients. The sum of the coefficients increased as the lag was extended, however, suggesting that, although great weight in the formation of price expectations comes from quite recent experience, the total adjustment procedure is probably somewhat longer, with only relatively small weight given to price movements in the distant past. In other words, the "true" distribution probably has a "tail" of small declining coefficients. These results suggest a much shorter time horizon information of price expectations than had been found in the investigations cited earlier.

Due to multicollinearity, direct estimation of an unconstrained distributed-lag function tends to result in wildly fluctuating coefficients. In order to reduce this fluctuation, the relationships were estimated using the Almon lag technique.[19] This procedure results in a much smoother distribution, which is more

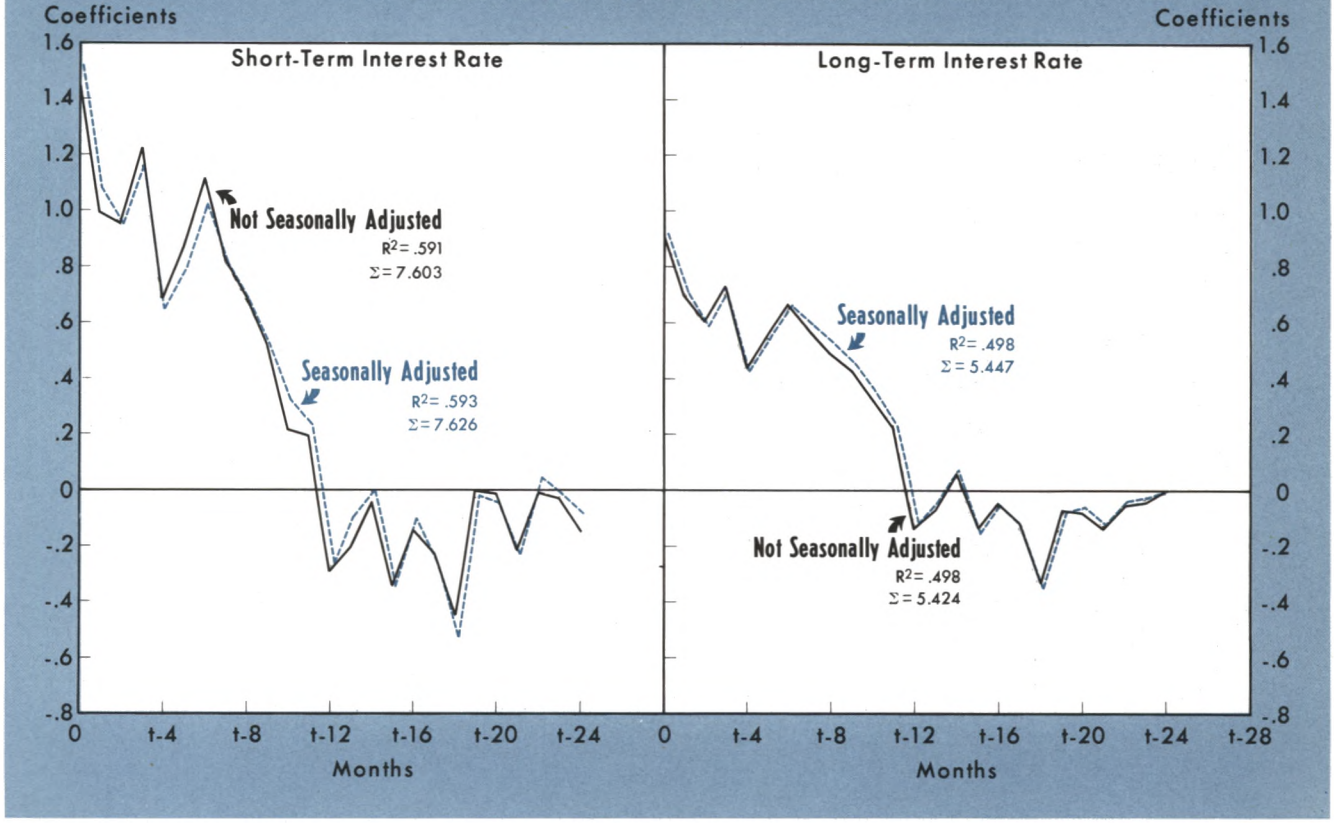
[18]Multicollinearity (correlation between independent variables) is a possible source of difficulty in estimation of this type of distributed-lag relationship. In the presence of multicollinearity, the ordinary least squares regression technique is unable to identify the exact parameter associated with each independent variable. See J. Johnston, *Econometric Methods* (New York: McGraw-Hill, 1963), pp. 201-207.

[19]Shirley Almon, "The Distributed Lag Between Capital Appropriations and Expenditures," *Econometrica*, January 1965, pp. 178-196.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Chart II

Regression Results Using Seasonally Adjusted and Not Seasonally Adjusted Interest Rates



consistent with the adaptive-expectations hypothesis, that is, expectations are a continuous function of past price movements.

The Almon lag estimates are presented in Chart III[20]. The distribution of the Almon coefficients follows the least squares estimate quite closely. For lags from 24 to 48 months, most of the effect on interest rates come from price movements over the previous year. The tails of coefficients beyond these points sum to nearly zero.

The regression using 48 lags suggests that, if the annual rate of change of the consumer price index increased by one per cent in a given month (for example, from a 3 per cent annual rate of increase to a 4 per cent annual rate) and prices continued to rise at that rate, the yields on four- to six-month commercial paper would rise 72 basis points (for example, from 4 per cent to 4.72 per cent) during the first year, if all other factors affecting interest rates were unchanged. After 48 months, short-term interest rates would have risen by 69 basis points.[21]

[20]The regressions presented here were generated using a sixth-degree polynomial. Other degree polynomials were tested and gave similar distributions. The sixth-degree was chosen because it best approximated the unconstrained estimates, in that it minimized the sum of the squares of the difference between the unconstrained and Almon estimates. The only constraint on the selection of the degree of the polynomial is that it must be less than or equal to the number of lagged coefficients. The sixth-degree polynomial was the maximum which could be used in the program available to the authors.

[21]In the long run, the nominal rate of interest does not rise by the full amount of the change in price expectations. An increase in price expectations will increase the difference between the nominal and Wicksellian market rates. However, the change in price expectations will tend to lower the market rate. Assuming an equilibrium position with expected price changes equal to zero, then $rm_t = rm_t$. If price expectations increase by one per cent per year, after 4 years the nominal interest rate will rise by 69 basis points, thus

$$(1) \quad rm_{t+48} - rm_{t+48} = 1.00$$
$$(2) \quad rm_{t+48} - rm_t = 0.69$$

Since $rm_t = rm_t$, equations (1) and (2) reduce to

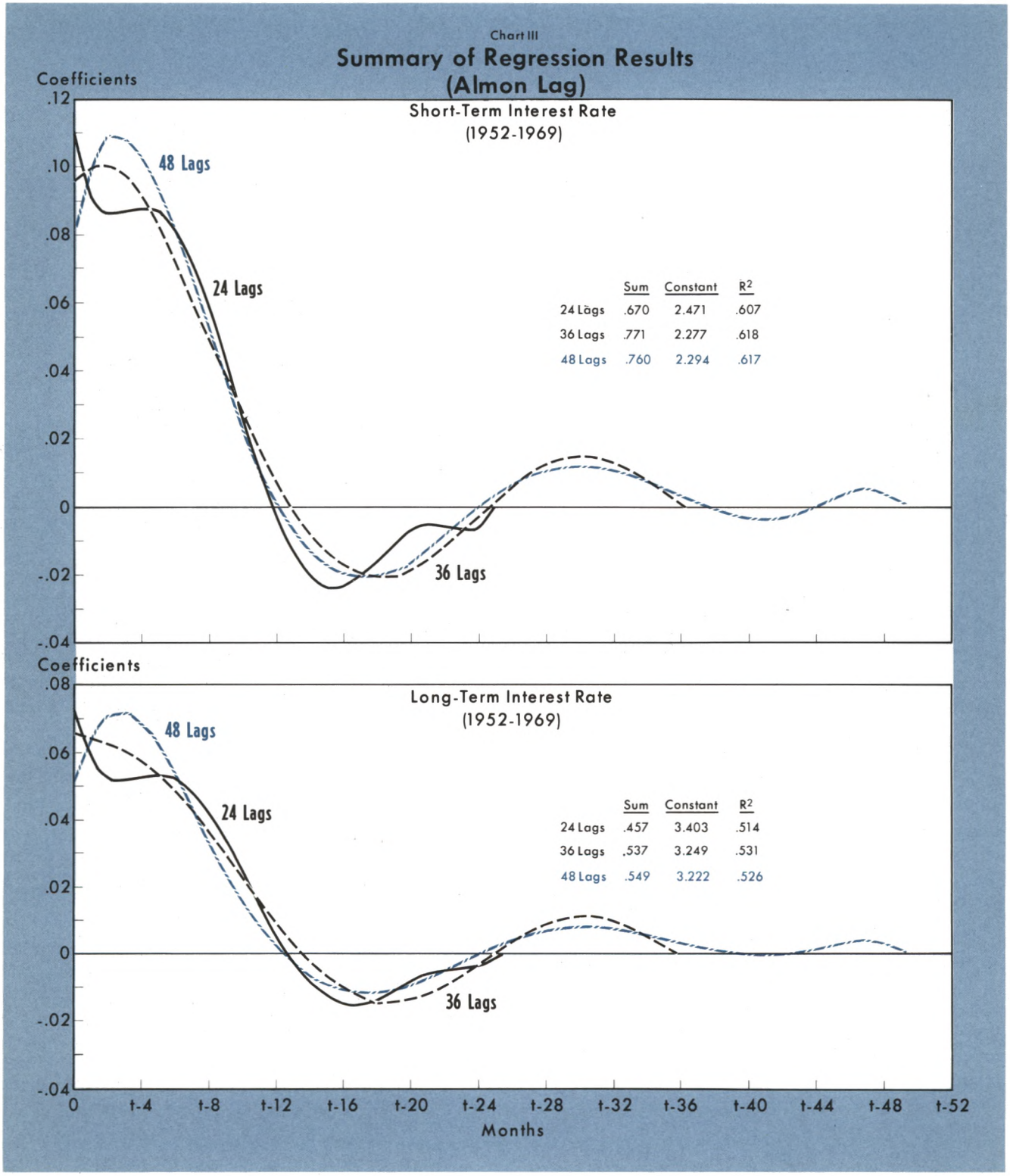
$$(3) \quad rm_{t+48} - rm_t = -0.31$$

Thus the market interest rate falls by 31 basis points following the increase in price expectations. This result is consistent with findings of other investigators; for example, see Keith M. Carlson and Denis S. Karnosky, *The Influence*

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Chart III

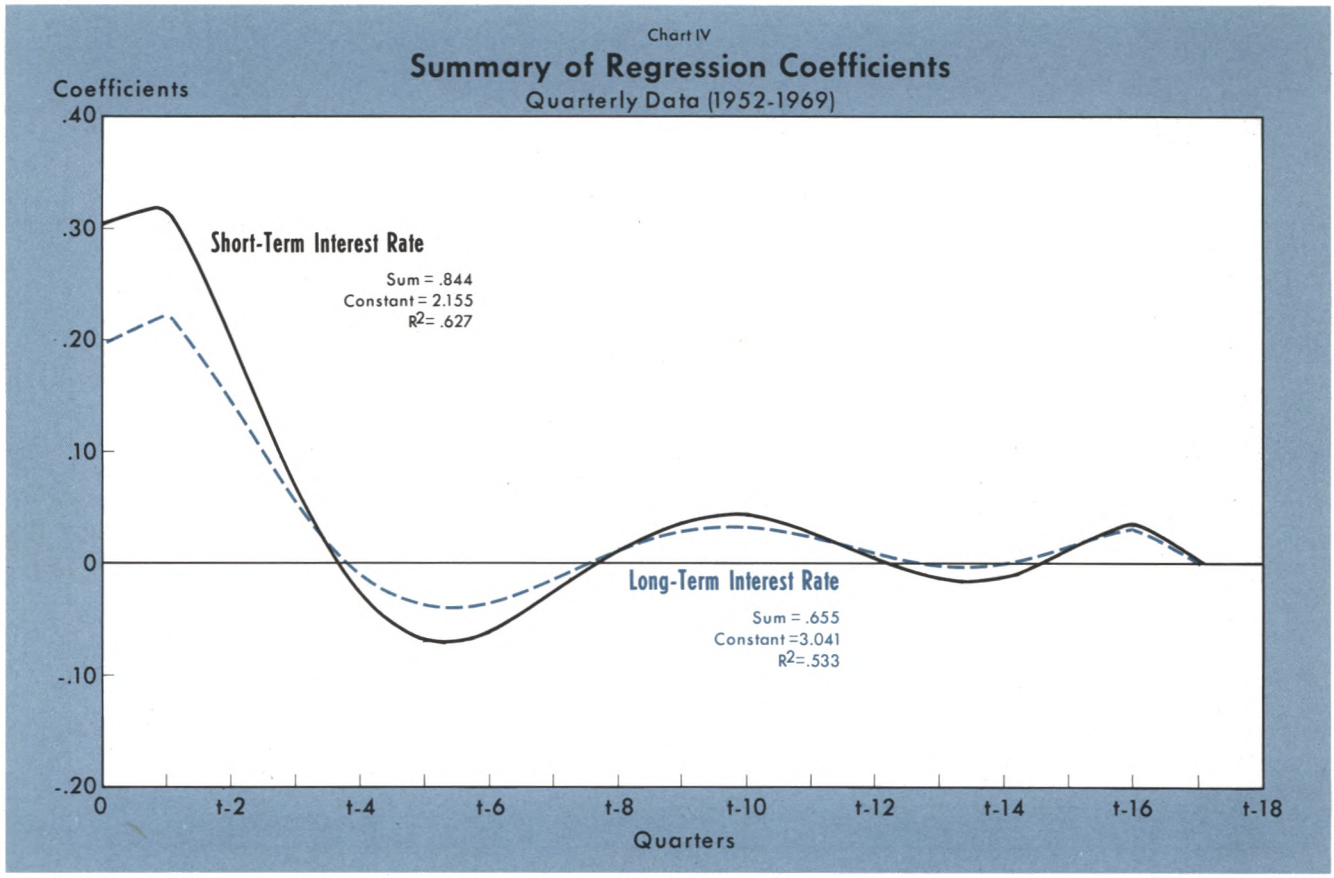
Summary of Regression Results (Almon Lag)



of Fiscal and Monetary Actions on Aggregate Demand: A Quantitative Appraisal, Federal Reserve Bank of St. Louis, Working Paper No. 4, March 1969. In the aggregate demand model developed there, an increase in expected prices *ceteris paribus* generates a Government budget surplus which results in a decrease in the stock of wealth and reduces the "real" interest rate. The net result is an increase in nominal rates less than the increase in expected prices.

Fisher hypothesized that the time horizon in forming price expectations was related to the term to

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



maturity of the instrument. Potential buyers and sellers of long-term debt would be interested in how prices move over an extended period and would tend to look further into the past than would those people who were dealing in short-term instruments. Participants in the market for short-term securities are less likely to be concerned with long-term price movements and might need less information in forming their expectations. The results in the present study are consistent with this idea.

The long-term interest rate is relatively less responsive to changes in price expectations. Twelve months after the one per cent increase in prices, long-term rates would be 59 basis points higher than they were originally, as opposed to 72 basis points for short-term rates. The effect on long-term rates would be a total increase of 56 basis points after 48 months.

Why Such Long Lags In Earlier Studies? — Three Hypotheses

The present study has found mean lags for the effect of price level changes on both long-term and short-term interest rates of less than a year. In contrast, earlier studies yielded mean lags of anywhere from seven to thirty years. It is important to try to explain this discrepancy and to defend the results presented here.

The authors have explored three hypotheses that might reconcile the differences:

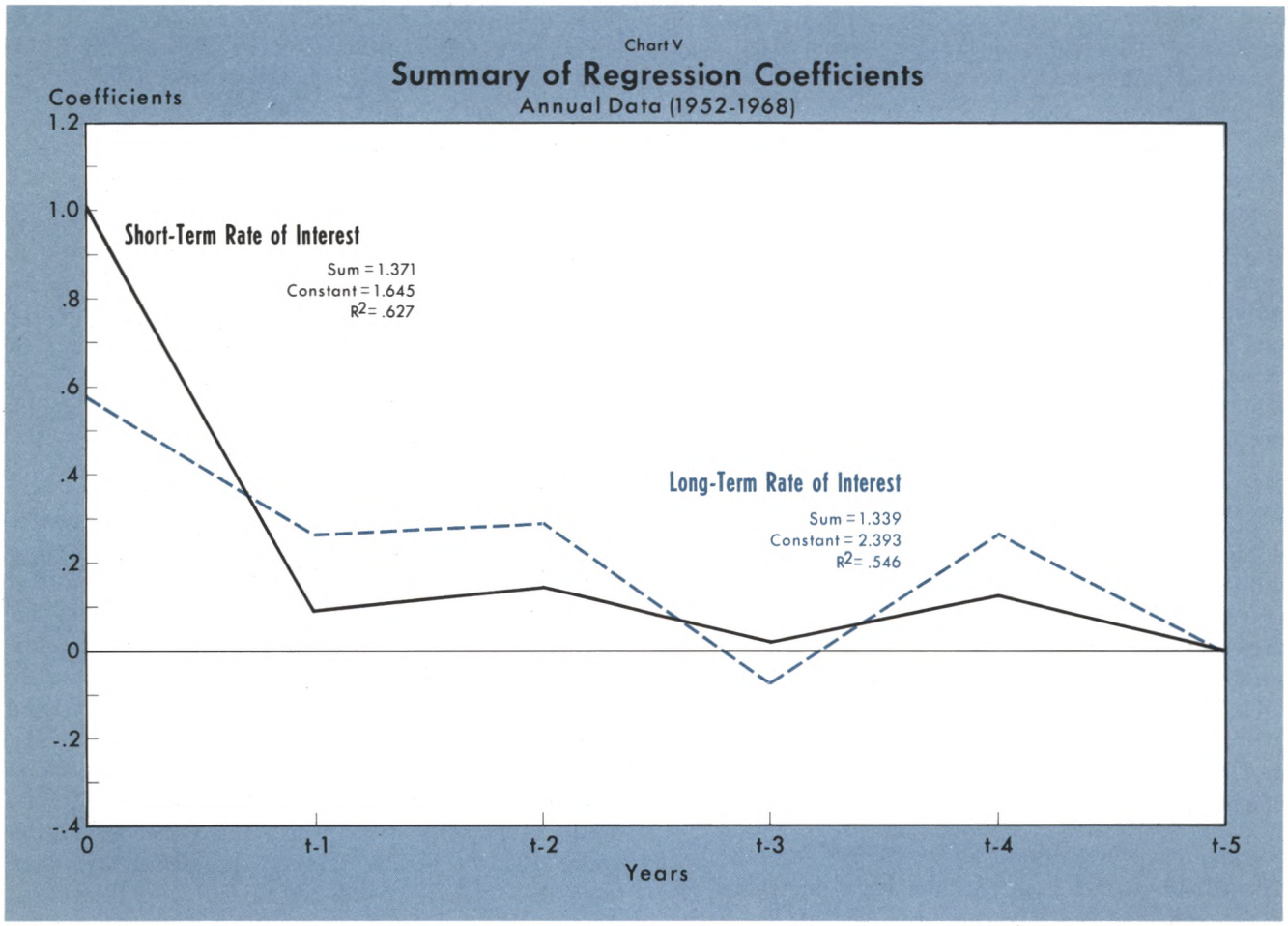
(1) The "true" lags of interest rates behind price changes are short, so that biases arise in aggregating the interest rate and price change series over longer observation periods, which lead to systematic overestimates of the length of the lags.[22]

(2) The forms of the lags estimated in other studies, in contrast to the more flexible class of lags estimated in this study, are biased toward yielding longer average lags.

(3) Institutional changes have occurred over time in financial and real markets, with the result that price level changes have come to have prompter

[22]Griliches, pp. 45-46; Yair Mundlak, "Aggregation Over Time in Distributed Lag Models," *International Economic Review*, May 1961, pp. 154-163; and William R. Bryan, "Bank Adjustments to Monetary Policy: Alternative Estimates of the Lag," *American Economic Review*, September 1967, pp. 855-864. Griliches summarizes the issue as follows: "aggregation over time (e.g., from quarterly to annual data) will in general result in a misspecification of the model. It will also . . . cause us to overestimate the implied average lags."

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



and larger effects on interest rates.[23] To put it differently, there has been considerable thinning of the "molasses (long-lag) world," particularly in the past decade.

Aggregation of Data

To test the first hypothesis, the monthly data for all of the interest rate series and the rate of change in the consumer price index were aggregated to quarterly and annual averages of monthly data for the 1952-69 period. Almon distributed lags over 16 quarters with sixth-degree polynominals were estimated for the quarterly series. The results (see Chart IV) were virtually identical to the original monthly regressions with 48 month lags and the same degree polynomials.[24]

[23]The post-war increase in the degree of financial "market perfection" and its consequent effect on interest rate flexibility is the subject of James S. Duesenberry's essay, "The Effect of Policy Instruments on Thrift Institutions," in *Savings and Residential Financing: 1969 Conference Proceedings*, pp. 135-143.

[24]Fukasawa has run unconstrained lags extending back six quarters with quarterly data from IV/1951-IV/1968 for Treasury bill and bond rates regressed on the rate of change in the GNP deflator. His results are similar to those reported here.

The quarterly regressions suggest that if the annual rate of change of prices increases by one per cent in any quarter and remains at the higher level the short-term rate would rise by 84 basis points after 4 years. The long-term rate would rise by 66 basis points over the same period. Using the results of the monthly estimates, an increase by one per cent in the annual rate of change in prices, would yield an increase of 69 basis points in short-term rates and 56 basis points in long-term rates after four years.

There were too few observations, given the length of the lags and the degree of the polynomials, to fit Almon lags to the annual observations, so only unconstrained lags were estimated, ranging from one to five years (see Chart V). For the unadjusted commercial paper rate, the R^2 was highest (0.709) with only the current rate of change in prices in the regression; in all cases, only the coefficient for the current price changes was significant. As might be expected, the R^2 for the unadjusted corporate Aaa yield was highest (0.552) when the current and one year lagged price change term were included, although in every

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

case only the coefficient on the current term was significant. The regressions using annual data gave somewhat larger total effects. If the rate of change of prices rises by one per cent per year, short-term rates would be 137 basis points higher after four years. Long-term rates would rise by 134 basis points.

The discrepancy between this and earlier studies apparently cannot be explained on grounds of an aggregation bias in the latter, and the first hypothesis cannot be accepted. The reason probably lies in the fact that the adjustment of interest rates to price level changes is not so rapid that aggregation of monthly into quarterly and annual data leads to systematic overestimates of the underlying lags.

Estimation Procedure

The second hypothesis pertains to the nature of the lag distributions estimated in other studies. Since several of the studies have estimated geometrically decaying (Koyck) lags, the monthly data used in the earlier part of the present study were used to estimate such lags. The following regression was run for each of the yield series, using for $\dot{P}_t$ both the simple monthly rate of change and compounded annual rates of change:[25]

$$rm_t = \lambda rm_{t-1} + \beta \dot{P}_t + \text{constant}$$

The decay coefficient λ, presumably somewhere between zero and one, indicates the rate at which the weight of the past rates of price change declines backward in time (that is, $\lambda = 1$ means that the lagged terms never decay at all, while $\lambda = 0$ means that only the current price change term has any effect).

All of the initial regressions yielded decay coefficients slightly greater than one, which, taken at face value suggests that the lagged terms do not decay.

$$rm^s_t = 1.012\ rm^s_{t-1} + .057\ \dot{P}^c_t - .024 \qquad R^2 = .980$$

$$rm^L_t = 1.007\ rm^L_{t-1} + .053\ \dot{P}^c_t - .020 \qquad R^2 = .994$$

A danger in such estimates of the decay coefficients and the β parameter is that they are inconsistent, and the estimate of λ is probably biased upward.[26] Following procedures outlined by Griliches and by Goldberger, the decay coefficients were re-estimated, which reduced them by only a very small amount:

$$rm^s_t = 1.005\ rm^s_{t-1} + .071\ \dot{P}^c_t - .024$$

$$rm^L_t = 1.003\ rm^L_{t-1} + .054\ \dot{P}^c_t - .020$$

Decay coefficients greater than one are clearly inconsistent with the adaptive expectations hypothesis. It would not be unreasonable to expect decay coefficients only slightly less than one to result from tests using different sample periods or data definitions than were used here.

The monthly data were divided into two subperiods, 1952-60 and 1961-69, and separate estimates of the decay coefficients obtained. For the earlier period, the coefficients dropped below one, ranging (unadjusted for consistency) from 0.977 for commercial paper rates to 0.996 for corporate Aaa yields. These results imply long mean lags for both interest rates, with longer lags for the long-term rates. The coefficients on the current rate of price change in the commercial paper rate regressions strangely became negative for the 1952-60 period.[27] For 1961-69, the decay coefficients were nearly the same as for the entire 1952-69 period, that is, slightly greater than one, for which it is difficult to find any theoretical rationalization.

To see what would happen to the decay coefficients, the monthly data were aggregated into quarterly data and the decay coefficients re-estimated for the 1952-69 period and for the subperiods mentioned above. All of the decay coefficients for the entire period declined, which would be expected if a monthly decay process were to be converted into an equivalent quarterly process, but the decay coefficients for short-term rates fell to below one (0.968 for commercial paper rates, with a mean lag of 20 quarters or five years). For 1952-60 alone, all the coefficients were less than one, but the decay process was again negative for short-term rates. For 1961-69 the results were all plausible, and the decay coefficients were

[25]This is the convenient form in which such lags are usually estimated. This equation may be expanded into the following:

$$rm_t = \lambda^0\beta\dot{P}_t + \lambda^1\beta\dot{P}_{t-1} + \lambda^2\beta\dot{P}_{t-2} + \ldots + \lambda^\infty\beta\dot{P}_{t-\infty} + \text{constant}$$

or, more simply,

$$rm_t = \beta\sum_{i=o}^{\infty} \lambda^i\dot{P}_{t-i} + \text{constant}.$$

[26]See Griliches, p. 41, and Arthur S. Goldberger, *Econometric Theory* (New York: John Wiley and Sons, 1964), pp. 276-278, and Kenneth F. Wallis, "Some Recent Developments in Applied Econometrics: Dynamic Models and Simultaneous Equation Systems," *Journal of Economic Literature*, September 1969, pp. 774-775.

[27]This implies that the lagged price change effects are opposite in sign from those hypothesized; they could be interpreted as evidence for Sargent's "regressive effects" of price changes on short-term rates (see p. 32 below).

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

all lower than corresponding coefficients for 1952-60. The effect of price level changes on commercial paper rates for the latter period decayed with a λ of 0.834 (mean lag of about three quarters), while the decay factor was 0.919 (mean lag of seven quarters) for corporate Aaa yields.[28]

The preceding experiments with simple geometrically declining lag structures suggest that such lags, requiring an exponential decay, may not be the most appropriate ones to impose on the interest rate and price level data for the period of this study in the attempt to capture the "true" underlying lag distribution. In every case the average lags obtained with this procedure were considerably longer than with either unconstrained or Almon lags, which provides some explanation for the differences between this and previous studies.[29]

Institutional Changes

The third hypothesis asserts that price level changes have come to have larger and prompter effects on interest rates because of institutional changes in the economy. As a preliminary test of this hypothesis, the 1952-69 period was again divided into two subperiods, 1952-60 and 1961-69, and various Almon lag structures estimated separately for each.[30] Table I contains the sum of the lag coefficients for 12 to 48 lags and second- to sixth-degree polynomials.

As was the case with the entire period, there was little difference in the total price expectations effect between different degree polynomials. The length of the lag distribution was crucial, however. The total effect on short-term interest rates tended to decline as the lag was extended beyond 24 months, and this was quite pronounced in the 1961-69 period. The effect on long-term rates, however, increased as the lag was extended up to 36 months. Beyond 36 months, the sum of the coefficients remained almost constant. None of the coefficients beyond 48 months were significant. These results suggest that the time horizon in forming price expectations increases as the term to maturity of the security increases.

The total price expectations effect is much larger in the 1961-69 period than in the earlier period. In the latter period the total effect on short-term rates is about 90 per cent of the annual rate of change in prices. The effect on long-term rates is about 80 per cent of the rate of price change. In the 1952-60 period the sum of the coefficients range between 5 and 35 per cent of the price change for a lag of 36 months. Chart VI contains the lag coefficients for short-term rates (second-degree polynomial and 24 lags for 1961-69, and sixth-degree with 36 lags for 1952-60) for the relationship between the commercial paper rate and the rate of change in the consumer price

Table I

SUM OF THE REGRESSION COEFFICIENTS*
(monthly data)

Short-term interest rates

Degree of Polynomial	Length of Lag 1952-60 12	24	36	48	1961-69 12	24	36	48
2	.2825	.2265	.0899	—.0482	.9211	.9518	.8039	.5726
3	.2760	.2254	.3055	.1856	.9105	.9035	.7235	.5344
4	.2837	.2402	.3418	.1349	.9118	.9231	.7373	.4750
5	.2836	.2406	.3378	.0539	.9134	.9210	.7124	.4668
6	.2834	.2439	.3340	.0960	.9131	.9172	.7180	.4759

Long-term interest rates

Degree of Polynomial	Length of Lag 1952-60 12	24	36	48	1961-69 12	24	36	48
2	.1432	.1154	.0537	.0081	.5854	.7086	.8406	.8321
3	.1417	.1122	.1639	.1580	.5881	.7405	.8618	.7945
4	.1445	.1140	.2078	.1374	.5886	.7531	.8540	.8210
5	.1445	.1193	.2062	.0798	.5889	.7533	.8474	.8227
6	.1444	.1200	.2023	.0756	.5886	.7524	.8526	.8303

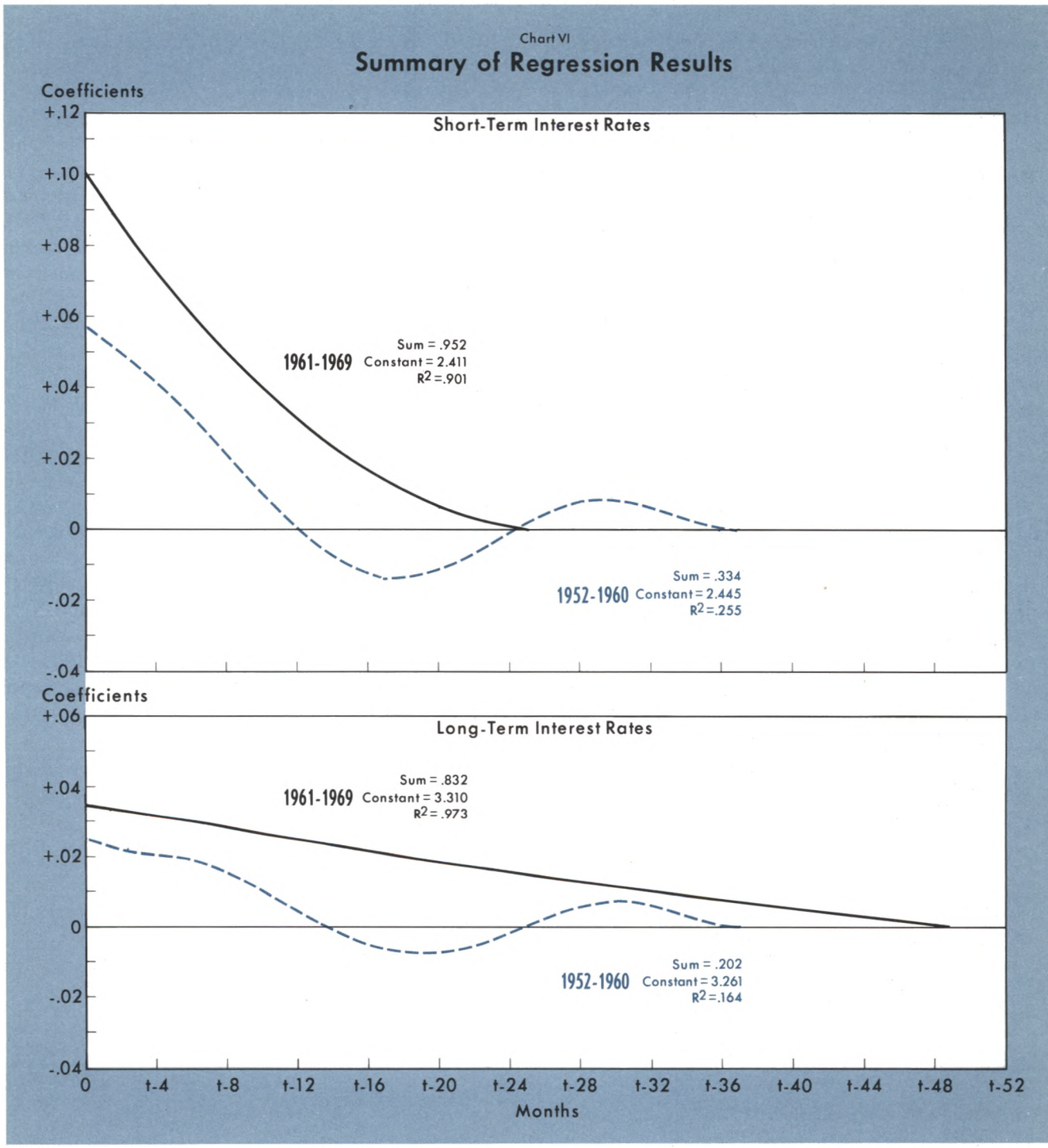
*All coefficients in the table for the 1961-69 period are significant at the one per cent level. Those for the 1952-60 period were insignificant for 48 lags.

[28]James B. Greene, using quarterly data for 1961-68, obtained a decay coefficient of 0.824 for the commercial paper rate regressed on the rate of change in the consumer price index, which implies a mean lag of about 2½ quarters; for the corporate Aaa yield his decay coefficient was 0.919 implying a mean lag of about seven quarters.

[29]Experiments were also conducted for the whole period and the subperiods with simple second-order lags (in the regressions the dependent variable was lagged one and two periods). The results were not appreciably different from those for the first-order lags.

[30]The "Chow test" was conducted to see whether there was a fundamental shift in behavior patterns within the 1952-1969 period. For both commercial paper rates and corporate Aaa yields the "F" statistics were significant at the one per cent level, which indicates a substantial difference in the anticipations forming mechanism in the two subperiods. For an explanation of the test, see Gregory C. Chow, "Tests of Equality between Sets of Coefficients in Two Linear Regressions," *Econometrica*, July 1960, pp. 591-605.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis



index. The sum of the coefficients for the earlier period was .344 and the mean lag, 1 to 2 months. For the latter period, the sum was .952, and the mean lag 4 to 5 months. While it is true that the smaller effect in the earlier period was exhausted more quickly (the mean lag was shorter), the peak in total effect for the earlier period was reached after eleven months, while the same level of effect was attained in the latter period in only 2 to 3 months. Further, the R^2 jumps from 0.255 to 0.901, so for the latter period the rate of change in prices accounts for over 90 per cent of the variation in commercial paper rates.[31]

[31]The highest R^2 (0.938) for the commercial paper rate was obtained for 1961-69 using sixth-degree polynomials and 48 month lags.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

These results are thus consistent with the hypothesis of the effect of institutional changes.[32]

Similar results were obtained for the corporate Aaa yield (Chart VI), and the jump in R^2 for the latter period is even more pronounced, from 0.164 to 0.973. The coefficients of the long-term rate were generated using a second-degree polynomial and 48 lags for 1961-69 and sixth-degree with 36 lags for 1952-60. All of the coefficients estimated for the 1961-69 period are significant at the one per cent level. A mean lag of 16 months is implied by this result, meaning more than half of the adjustments in interest rates to price changes in the period were attained in less than a year and a half. A summary of the 1961-69 regressions appears in the appendix.

What factors might cause a shift in the framework for transmitting past price level changes, via price expectations, to nominal interest rates? A listing of plausible explanations might include the following:

(1) According to Friedman and Schwartz, "the period used in forming anticipations should depend on the characteristics of price behavior," particularly the "variability in the behavior of the general level of prices."[33] Thus, one could argue that prices have been more variable, at least in an upward direction, in the 1950's and 1960's than over long, earlier historical periods. Further, the greater publicity given to price level movements, as well as the more rapid processing of data, could convey greater awareness of recent price level behavior and affect price level expectations and interest rates more substantially than once was the case.

(2) Nominal rates may have come to reflect past price level changes more fully both because of a decrease in "money illusion" and because of decreased effects of price changes on real wealth over time.[34] The former could be explained by the increased importance of large institutional investors in markets such as that for corporate bonds. For the latter to be a contributory factor, real wealth would have to be affected relatively less than before by price changes (because assets not fixed in nominal terms may have become relatively more important), thus reducing the "drag" on upward shifts in the saving function by the amount of expected price level changes.

(3) Interest rates are more flexible than in many past periods. According to Duesenberry,

> "Restrictive monetary policy has in the past operated to a large extent through [nonprice] rationing . . . . Market forces and public policy have been working toward perfecting capital markets, and thereby reducing the effectiveness of rationing . . . [and resulting in] a world requiring wide swings in interest rates for stabilization purposes . . ."[35]

Thus, one would expect to find larger coefficients linking price changes to interest rates than in the past.

(4) The frame of reference for forming expectations may well have changed, particularly in the 1960's. The relative absence of cycles in prices except for the very distant past deprives individuals of a succession of comparable reference points from which to extrapolate into the future and forces the use of heavier weights on the more recent past.

Price Expectations In An Expanded Model

A recent study by Thomas J. Sargent[36] differs from earlier studies of the effect of price expectations on interest rates in two important respects. Besides relating past price changes to nominal interest rates, he sought also to decompose the "real" rate into components representing the equilibrium "real" rate and the deviation of current "real" market rates from the equilibrium rate. In addition, the shapes of the distributed lags he estimated were more general, that is, capable of fitting the data into a greater variety of geometrical configurations.

Sargent devised a useful identity:[37]

$$\underset{\text{"Real" rate } (rm_t = rr_t)}{\underbrace{rm_t = \overset{(a)}{re_t} + \overset{(b)}{(rm_t - re_t)}}} + \underset{\text{Fisher effect } (\dot{P}^e_t)}{\underbrace{\overset{(c)}{(rm_t - rm_t)}}}$$

where re_t is the rate of interest at which real saving and investment would be in long-run equilibrium and rm_t is the current market level of the "real" rate, that is, rm_t is the same as rr_t in equation (1) above. Movements in the nominal rate may then be attributed to changes in the equilibrium rate (a), to a deviation between the equilibrium rate and the "real" market rate (b), and to a Fisher effect (c).

[32] Fukasawa has estimated unconstrained lags with quarterly data for five subperiods from 1951-68 and has obtained similar results.

[33] Friedman and Schwartz, p. 143.

[34] "Money illusion" means that behavior is based on and directed toward nominal magnitudes rather than "real" magnitudes, for example, investment outlay in money terms would be related to money income and nominal interest rates.

If real wealth influences the decisions of savers, the saving function would not shift upward by the expected rate of increase in prices because of expected decreases in the real value of assets fixed in nominal terms (for example, money), which dampen the effect of price expectations on nominal rates (see Robert Mundell, "Inflation and Real Interest," *Journal of Political Economy*, June 1963, pp. 280-283).

[35] Duesenberry, pp. 136 and 140.

[36] Thomas J. Sargent, "Commodity Price Expectations and the Interest Rate," *Quarterly Journal of Economics*, February 1969, pp. 127-140.

[37] Sargent, p. 130. It is an identity, since it simplifies to $rm_t = rm_t$.

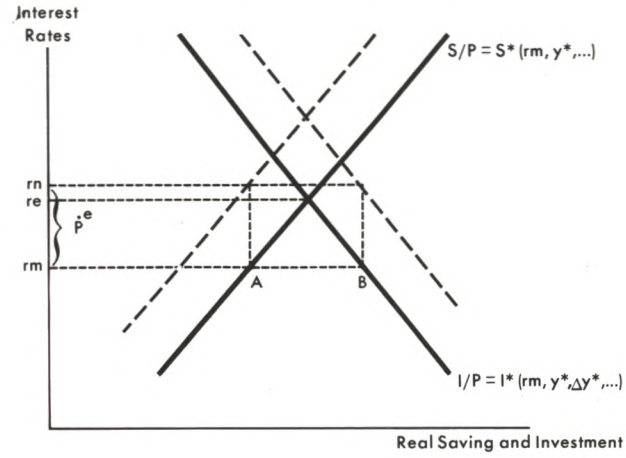
Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Earlier studies (including that which we have reported above) regarded either (b) or (a+b) as a residual and regressed nominal interest rates on past price changes only, but Sargent attempted to estimate each of the components of the level of nominal rates. The relationships among the components of the nominal rate and how he sought to identify them statistically are shown in Figure I. Assume that real investment (I/P) and real saving (S/P) are functions of real income and "real" market rates of interest and that real income is given (so shifts in the saving and investment schedules do not have to be accounted for). The equilibrium "real" interest rate (re) is the rate at which real saving and investment would be in equilibrium. The market rate (rm) below the equilibrium rate indicates that some portion (AB) of current investment is being financed from sources other than intended saving, for example, by newly created money from the banking system or through the drawing down of previously accumulated money balances. This is sometimes called the "Wicksell effect" on interest rates.[38]

Assuming savers and investors form the same price expectations and that neither are subject to "money illusion" (an important Fisherian concept[39]), both functions would be shifted upward by the expected rate of change in prices, $\dot{P}^e_t = rn_t - rm_t$.

Since the equilibrium rate cannot be directly observed, Sargent used a reduced form proxy for it. He solved his real saving and investment functions simultaneously, so that the one market rate consistent with equilibrium (equality of intended savings and investment) is a function of the other determinants of real saving and investment, namely real income and (from an investment accelerator) the change in real

Figure I
Illustration of Sargent's Identity



income. This solution was then used to measure component (a) in the equations he estimated. Similarly, having no independent observations for the market rate, he used another proxy, the current rate of change in the "real" (deflated) money stock, for the deviation of the market rate from equilibrium.[40]

Finally, Sargent estimated geometrically distributed lags on past price changes as a proxy for price expectations. Using annual data for 1902-40 (two of the regressions were also run for 1902-54) and taking for nominal rates Durand's one-year and ten-year basic yields, he obtained estimates implying very long mean lags (twenty years or more for short- and long-term rates).

In several of his regressions he estimated two sets of decay coefficients. Both were positive for the long-term rate; for the short-term rate one was negative and more quickly decaying, which Sargent rationalized as indicative of a "regressive effect" of price changes on short-term rates (as opposed to the positive "extrapolative effect"), that is, price changes temporarily generate expectations of changes in the opposite direction (that is, that they will move back to a "normal" level). The sum of the regressive and

[38]Knut Wicksell, *Lectures on Political Economy*, pp. 190-198, and *Interest and Prices* (London: Macmillan, 1936). Wicksell assumed that savers and investors expected current prices to continue into the future, so he did not need to account for price expectations effects on interest rates. As Sargent points out, views similar to Wicksell's were also held by Henry Thornton in 1802 and by Keynes in *A Treatise on Money*. Emphasis on the equilibrium rate-market rate relationship as the proper one in using interest rates as monetary policy indicators and rejection of price expectations effects on empirical grounds characterizes recent work of Patric H. Hendershott and George Horwich (see, for example, "The Appropriate Indicators of Monetary Policy, Part II," in *Savings and Residential Financing: 1969 Conference Proceedings*, pp. 42-44).

What is here called the "Wicksell effect" may also be interpreted as the "liquidity effect" or "impact effect" of changes in the money stock; similarly, the real GNP variables reflect the "income effect" or "feedback effect" on interest rates associated with changes in the money stock (see references to works by Friedman and Schwartz, Gibson, and Meltzer cited above).

[39]See footnote 34 above.

[40]In Figure I the gap between the equilibrium and market interest rates will widen as the portion of real investment not financed by current real savings (AB) increases. The rate of change in the real money stock, on the other hand, should be positively correlated with the magnitude of AB. As a proxy for (rm-re) the rate of money change should have a negative coefficient (that is, be positively related to an (re-rm) gap).

The entire reduced form for "real" rates should also capture the effects of other capital market disturbances, for example, Government surpluses or deficits and the ways they are financed (banking system versus nonbank public).

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

extrapolative weights did not reach a peak until eight years and declined even more slowly thereafter (since the negative component decayed more rapidly), so the mean lag would not be much different from his other results.

The authors have subjected Sargent's basic approach to a further test, with the following modifications:

(1) Both real saving and investment are assumed to depend on both real GNP and "real" market rates of interest. Thus, there is no *a priori* expectations as to the sign of the coefficient for the real GNP term in the regressions. A negative coefficient would presumably indicate that shifts in the saving function in response to a change in real GNP outweighed shifts in investment, so that nominal and "real" rates would tend to fall as real GNP rose.[41] A positive coefficient would suggest just the opposite, while a coefficient near zero might indicate roughly offsetting effects of saving and investment shifts.

(2) Quarterly and monthly instead of annual data are used, and as before, the emphasis is completely on the entire post-accord period and the 1961-1969 subperiod. The regressions with monthly data necessarily use proxies for real GNP (personal income deflated by the consumer price index and, alternatively, the index of industrial production) and the GNP price deflator (consumer price index).

(3) The interest rate series and distributed lag forms are different; further, regressions were run with and without a constant term (Sargent did not suppress the constant term in any of his regressions).

The equations estimated are of the following form:

$$rm_t = a_0 + \sum_{i=o}^{n} a_{i+1}\dot{P}_{t-i} + \beta_1 Y^*_t + \beta_2 \Delta Y^*_t + \beta_3 \Delta M^*_t$$

where $\dot{P}$ is the annual rate of change in the GNP deflator (or a monthly proxy), Y^* and ΔY^* are the level and rate of change in real GNP (or a monthly proxy), and ΔM^* is the average change in the real money stock (nominal money stock deflated by the GNP deflator or its monthly proxy). Nominal rates (rn) are again the four- to six-month commerical paper rate (rn^s) and the corporate Aaa yield (rn^L), using quarterly averages of monthly data in the quarterly regressions. Only results for the 1961-69 subperiod will be reported here, in Chart VII, and in the appendix.

The explanatory power of price level changes was changed little when the equations were more fully specified, and the adjusted R^2's rose by small amounts. For example in the equations for the long-term rate with second-degree Almon polynomials, total lags of 16 quarters (best statistical fit), and a constant term, the sum of the coefficients on current and lagged rates of price change actually rose from 0.80 to 0.86, and the R^2 was unchanged at 0.977 when the current real GNP and real change in the money supply were added to the regression; further, the mean lag for the effect of price changes on nominal rates increased from 3.2 quarters to 5.5 quarters. In other words, recent price changes alone tend to overstate the necessary adjustment of nominal rates to account for the Fisher effect. As would be expected, the coefficients on current and lagged rates of price change were redistributed toward the past in the expanded equations, since the current and last quarters' price levels implicitly enter into the other independent variables.[42]

Suppressing the constant term in the equation (that is, forcing a_0 to zero) forces a redistribution of its effects over the other coefficients. In the case of the long-term rate, the constant was not significant, and suppressing it enhanced slightly the explanatory power of real GNP and the change in the real money supply, lowered the sum of the price change coefficients (to 0.80) and the acceleration coefficient (β_2), left the R^2 virtually unchanged, and lengthened the mean lag (by three quarters with total lags of 16 quarters). In the case of the short-term rate, the mean lag rose from zero to nearly one quarter. Otherwise, the effects on the coefficients were exactly opposite to what happened when the constant was suppressed in the equation for the long-term rate.

Since the expanded equations contain variables not all measured in the same units, "beta" coefficients were computed in order to assess the relative contribution of each independent variable to the determination of nominal interest rates. In the equation for the long-term rate with various lag lengths the "beta" coefficient for price level changes is nearly three times as large as for real GNP, which ranks second in importance.

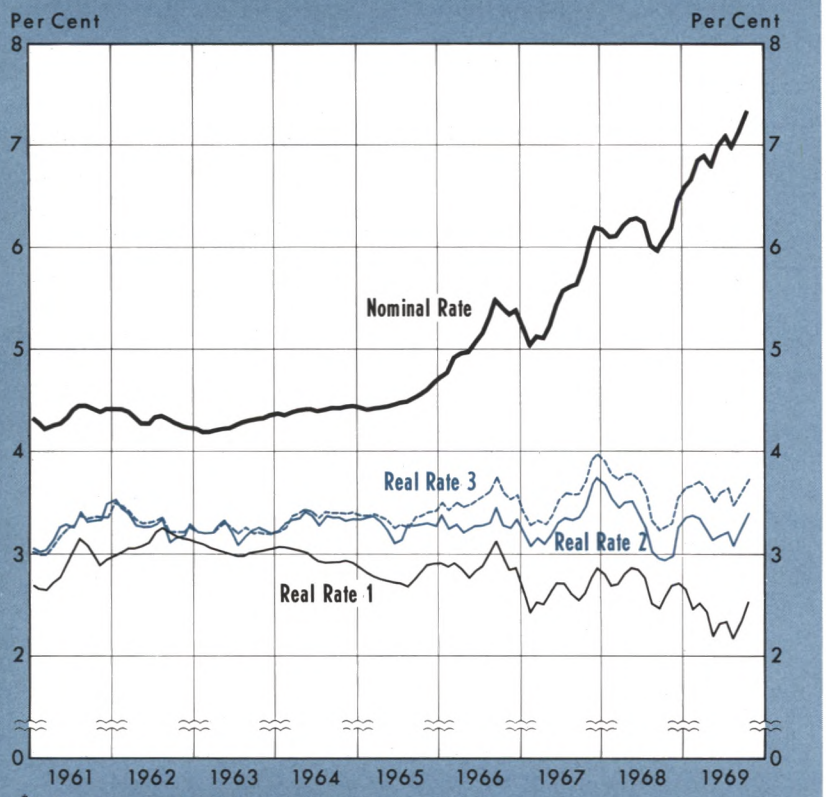
[41] Sargent obtained negative coefficients in all of his regressions. In his theoretical model he assumed that only saving was functionally related to the level of real GNP.

[42] The equation was also estimated for various lengths of total lags without the current rate of price level change (all of Sargent's regressions were of this form) to try to reduce multicollinearity. With total lags of 16 quarters, the sum of the coefficients on the lagged price changes $\left(\sum_{i=o}^{n} a_{i+1}\right)$ rose slightly, β_1 and β_2 remained about the same, β_3 declined in absolute value by about 10 per cent, and the R^2 and Durbin-Watson statistics rose slightly.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Chart VII

Estimated Long-Term Real Interest Rates*



*Yields on corporate Aaa bonds
Latest data plotted: October

Sargent's expanded model was also tested with monthly data, using alternatively, personal income deflated by the consumer price index and the index of industrial production as proxies for the real GNP (a series derived from the regression using the latter appears in Chart VII as "real" rate 3). The results closely paralleled those for the equations using quarterly data. For example, in the equation for the long-term rate with a total lag of 48 months, the index of industrial production as the real GNP proxy, and a constant term (which was significant in the monthly regressions), the sum of the price change coefficients fell from 0.87 to 0.82, the mean lag rose slightly from 15.6 to 16.4 months, and the R^2 went from 0.968 to 0.971.[43] The change in industrial production and the change in the real money supply had the correct signs but were not significant; one month is probably too short a period to capture the full "Wicksell (liquidity) effect." The level of industrial production turned out to be quite significant, but the coefficients were smaller than in the quarterly regressions, suggesting that the response of the equilibrium "real" rate of interest to real income growth may occur over a substantially longer period than the current month.[44]

Thus, the findings reported in this section appear to support the specification of variables in Sargent's model. The use of quarterly and monthly data over post-accord period and the estimation of Almon lags provide better statistical results than in his study. The importance of price level changes in explaining nominal interest rates is diluted very little by the expanded equations, and the mean lags are not sufficiently lengthened to alter the conclusions of the earlier sections of the present study.

Experimental Time Series For The "Real" Rate of Interest

The Federal Reserve Bank of St. Louis began calculating and publishing an experimental monthly series for the expected "real" rate of return on Corporate Aaa bonds in 1966.[45] The procedure employed was to subtract from the actual Aaa yield a simple average of rates of change in the implicit GNP price deflator for the previous twelve months (quarterly price deflator data were interpolated to obtain an estimated monthly index). Such a procedure necessarily implies that the mean lag is half as long (six months) as the total lag and that the co-

[43]Results using personal income deflated by the consumer price index were virtually identical to those using the index of industrial production as the proxy for real GNP.

[44]It should also be noted that there is another possible source of mis-specification in all of the expanded equations, namely, the interrelationship between changes in the nominal money stock and both price levels and rates of change. In other words, the monetary authorities would be expected to respond to departures from stable prices. One way around this problem is to make the policy variable endogenous in a simultaneously estimated model containing a "reaction function" for the Federal Reserve (see Michael W. Keran and Christopher T. Babb, "An Explanation of Federal Reserve Actions (1933-68)," this *Review*, July 1969, pp. 7-20; and Raymond G. Torto, "An Endogenous Treatment of the Federal Reserve System in a Macro-Econometric Model," unpublished dissertation, Boston College, 1969.

[45]"Strong Total Demand, Rising Interest Rates, and Continued Availability of Credit," this *Review*, August 1966, pp. 3 and 4.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

efficients are constrained to sum to one.[46] Shortly afterward the lag for averaging price changes was extended to 24 months (mean lag of 12 months), and the resulting proxy for the "real" rate has been reported periodically ever since. As a testimonial to the intuition of the series' creator, the distributed lag results in the present study yield estimates of the magnitude of effect and the mean lag which are remarkably close to the original "real" rate series.

Chart VII contains the nominal corporate Aaa yield from 1960 to October 1969 and various estimated monthly "real" rate series. "Real" rate 1 is the original series, that is, the nominal rate minus the average of rates of price change over the preceding two years. "Real" rate 2 is obtained from the regression using monthly data for 1961-69, total lags of 48 months, and second-degree polynomials. "Real" rate 3 is derived from the regression reported in the preceding section, which seeks to explain the contribution of "real" rates, as well as price expectations to nominal rates of interest; "real" rates here are assumed to be related to the level of and changes in the index of industrial production and changes in the deflated money stock.

Detailed analysis of the movements in these series will require a separate study.[47] Only a few observations will be made here. The pattern of movement in all three "real" rate series is remarkably similar. The old "real" rate 1, however, appears to have overstated the price expectations component of the nominal rate over most of the period. What is of particular interest are the occasions when changes in nominal rates gave apparently false signals about the nature of changes in "real" rates and the extent of agreement about directions of movement among the three "real" rate series.

All three "real" rates indicated that credit conditions were progressively tighter during the first half of 1961, when the nominal rate was virtually unchanged. The nominal rate was a reasonably good proxy for "real" rates 2 and 3 during 1962 but not for "real" rate 1, which rose for most of the year (the consequence of heavier implicit weights than the other two series on price changes two years earlier and lighter weights on the past year). The gradual upward creep in prices from 1963-65 caused "real" rate 1 to creep smoothly downward, generally opposite in direction to the nominal rate. With the different pattern of weights, movements in the "real" rates 2 and 3 were more pronounced, indicating that underlying price level changes were not entirely smooth over the interval.

"Real" rates 1 and 2 fell and "real" rate 3 oscillated around a constant level during the first half of 1966, while the nominal rate rose. From late 1966 until early 1967, all rates moved down in step. From 1967-69, the original "real" rate 1 tended to drift downward and oscillate somewhat ambiguously, although the three "real" rate series fell before nominal rates declined in the summer of 1968.

"Real" rates 2 and 3 moved upward with the nominal rate from late 1968 until early 1969. For several months thereafter, nominal rates did not rise by enough to offset the effects of rapid inflation, with the consequence that the monthly "real" rates actually fell from about February until late in the summer. Such movement in "real" rates could be used to explain, in part, the strength of the 1969 surge in investment spending.

Conclusions

Citing the findings by Gibson and Sargent of long lags in the forming of price expectations, Hendershott and Horwich recently argued:

> . . . Their experience contradicts the monetary voices in government, industry and the academy that proclaim, but do not demonstrate, that price level expectations, rather than real forces, are largely responsible for interest rate movements in this decade.[48]

In contrast, the present study has shown that, unlike the earlier historical periods on which most of the previous studies have been based, price level changes since 1952 have evidently come to have a prompt and substantial effect on price expectations and nominal interest rates. In addition, the total effect of price expectations on interest rates and the speed at which they are formed appear to have increased greatly since 1960. This conclusion is invariant to the form or the term of the flexible classes of distributed

[46]Mathematically, $\dot{P}^e_t = \sum_{i=1}^{n} \frac{1}{n} \dot{P}_{t-i}$, where n is the length of the total lag, and there are exactly n coefficients, each of which equals $1/n$ (hence, the sum is $n \cdot 1/n = 1$). Moving averages with equal weights are discussed by Griliches, p. 25.

[47]A variety of other monthly and quarterly "real" rate series have been computed, including short-term "real" rates.

[48]Hendershott and Horwich, "Appropriate Indicator," p. 44. Criticizing the earlier "St. Louis "real" rate," they continue, "The Fisherian zeal of that institution would shock no one more than Irving Fisher, who himself stressed the fantastically long lags in the formation of price level expectations and their impact on interest rates in this country."

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

lags estimated. Most significant is the finding that price level changes, rather than "real" rates, account for nearly all the variation in nominal interest rates since 1961. Furthermore, the addition of variables to the regressions to account explicitly for the "real" rate components of nominal rates does not appreciably alter these findings.

The causes of price level changes over the period of the study have not been investigated. The primary concern has been to determine the extent to which nominal rate movements may be attributed to expectations about future rates of change in prices, so that nominal rates may consequently be adjusted to yield information about movements in underlying "real" rates.[49] The failure to make such an adjustment and the sole use of changes in nominal rates as indicators of monetary ease or tightness may on occasion give misleading information about the direction and the extent of movements in "real" rates. The importance of the Fisher effect to the controversy over appropriate monetary policy indicators has been succinctly stated by David Fand:

> . . . As we get closer to a world of high employment, and especially if interest rates and prices are both rising, the money stock may be a better (less misleading) indicator or target variable than [nominal] interest rates. Paradoxically, the current tendency to emphasize interest rates and to ignore changes in the money stock would seem more relevant to a society where interest rates and prices are falling while the money stock is constant, or rising at a lower rate than output.[50]

According to economic theory, changes in "real" rates should then reflect both shifts in the equilibrium relationship between real saving and investment and current capital market disequilibrium. Further, it is such "real" rate series that should be employed in studies of the term structure of interest rates and of the effects of international interest rate differentials on short- and long-term capital flows.

[49]An interesting attempt to "neutralize" interest rates with respect to the impact of movements toward or away from full employment was reported in Dennis R. Starleaf and James A. Stephenson, "A Suggested Solution to the Monetary Policy Indicator Problem: The Monetary Full Employment Interest Rate," *Journal of Finance*, September 1969, pp. 623-641. Unfortunately, the authors did not incorporate price level changes into their analysis, which is a serious deficiency in their work.

[50]David Fand, "Keynesian Monetary Theories, Stabilization Policy, and the Recent Inflation," *Journal of Money, Credit and Banking*, August 1969, p. 576.

This article is available as Reprint No. 49.

The Appendix to this article begins on the next page.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

APPENDIX

Nominal Income As a Proxy for Prices

Gibson suggested that movements in nominal income might serve as a measure of price behavior. His reasoning was that the CPI might be unable to accurately measure short-term price movements since it is a selective index of prices. Nominal income, on the other hand, contains an implicit general price index.

Regressions using current and lagged monthly rates of change of nominal personal income ($\dot{P}^y$) were run and the patterns of coefficients are similar to those resulting from the runs using the CPI. To adjust for the difference in magnitude between the income and price index series, "beta coefficients" were computed in Table 1 below.[1]

Table I

SUM OF THE BETA COEFFICIENTS (1952-69)

	Short-term rates		Long-term rates	
	$\dot{P}^y$	$\dot{P}^c$	$\dot{P}^y$	$\dot{P}^c$
24 lags	2.020	1.301	1.502	1.259
36 lags	2.090	1.526	1.659	1.532
48 lags	2.489	1.581	2.230	1.767

The expectational effects of prices on interest rates, as indicated by movements in nominal income, are larger than those suggested by movements in the CPI. In addition, use of nominal income results in somewhat longer lags, but almost all of the effect still occurs within two years.

The Real Rate of Interest Series

The "real" interest rates (series 2 and 3) presented in Chart VII are actually the Wicksellian "market" rate ($\overset{L}{rm}_t$) or the long-run equilibrium interest rate plus any deviations due to short-run changes in financial markets. The series 2 was generated from the following relationship:

$$(1) \quad \overset{L}{rm}_t = a_o + a_1\dot{P}^c_t + a_2\dot{P}^c_{t-1} + \ldots + a_{49}\dot{P}^c_{t-48}$$

Table II

REGRESSION COEFFICIENTS

$$\overset{L}{rm}_t = a_o + a_1\dot{P}^c_t + a_2\dot{P}^c_{t-1} + \ldots + a_{49}\dot{P}^c_{t-48}$$

(January 1961 - September 1969)

i	a_i	t-value	i	a_i	t-value
1	.0353	12.0858	26	.0157	9.7358
2	.0345	13.1201	27	.0150	9.0360
3	.0336	14.3521	28	.0143	8.4246
4	.0379	15.8421	29	.0136	7.8860
5	.0320	17.6765	30	.0129	7.4081
6	.0311	19.9822	31	.0122	6.9812
7	.0303	22.9498	32	.0115	6.5977
8	.0295	26.8700	33	.0108	6.2512
9	.0287	32.1786	34	.0102	5.9368
10	.0279	39.4389	35	.0095	5.6501
11	.0271	48.8697	36	.0088	5.3876
12	.0263	58.1807	37	.0082	5.1465
13	.0255	60.2678	38	.0075	4.9243
14	.0247	52.6500	39	.0068	4.7187
15	.0240	42.4812	40	.0062	4.5281
16	.0232	34.1415	41	.0056	4.3508
17	.0224	28.0102	42	.0049	4.1855
18	.0217	23.5262	43	.0043	4.0311
19	.0209	20.1742	44	.0037	3.8864
20	.0201	17.6006	45	.0030	3.7506
21	.0194	15.5743	46	.0024	3.6229
22	.0187	13.9431	47	.0018	3.5027
23	.0179	12.6048	48	.0012	3.3892
24	.0172	11.4886	49	.0006	3.2819
25	.0165	10.5443	Constant	3.3102	75.0635

$R^2 = .9726$

[1]Arthur S. Goldberger, *Econometric Theory* (New York: John Wiley & Sons, 1964), pp. 197-198.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table III

REGRESSION COEFFICIENTS

$$rn^s_t = \alpha_o + \alpha_1 \dot{P}^e_t + \alpha_2 \dot{P}^e_{t-1} + \ldots + \alpha_{25} \dot{P}^e_{t-24}$$

(January 1961 - September 1969)

i	α_i	t-value	i	α_i	t-value
1	.1004	8.5196	14	.0270	5.0272
2	.0932	9.5951	15	.0232	4.1044
3	.0861	11.0731	16	.0197	3.3932
4	.0794	13.2080	17	.0166	2.8291
5	.0729	16.4751	18	.0136	2.3712
6	.0667	21.6709	19	.0110	1.9923
7	.0608	28.6477	20	.0086	1.6737
8	.0552	29.5467	21	.0065	1.4023
9	.0498	21.5108	22	.0046	1.1682
10	.0447	14.7557	23	.0031	0.9643
11	.0398	10.6173	24	.0018	0.7852
12	.0353	8.0147	25	.0008	0.6266
13	.0310	6.2682	Constant	2.4111	25.8957

$R^2 = .9006$

which was estimated by the Almon lag technique, using data for the period January 1961 to September 1969. The series presented is the difference between the actual Aaa yield in each month and the cumulated effect of past prices, or

$$(2) \quad rm^L_t = rm^L_t - \sum_{i=1}^{49} \alpha_{i+1} \dot{P}^e_{t-i}$$

The α_i are the estimated coefficients in equation (1) above and P^e_t is the annual rate of change of the consumer price index:

$$(3) \quad \dot{P}^e_t = \left(\frac{CPI_t}{CPI_{t-1}}\right)^{12} - 1$$

Notice that the constant (α_o) in equation 1 does not appear in equation 2. The estimated coefficients α_i are presented in Table II. Estimated coefficients for the short-term interest rate are presented in Table III.

Further Tests of Sargent's Results

The regressions presented so far attempted to measure the effect of price expectations by regressing nominal interest rates on current and past prices only. Thus the effects of all other factors affecting nominal rates were averaged into the constant term. This approach carries with it the danger of misinterpretation, if the excluded factors affect both the dependent and included independent variables. To test for this possibility, Sargent's approach of explicitly considering some of these other factors was applied.

Using Sargent's model, real output (Y^*), the change in real output (ΔY^*), and the change in real balances (ΔM^*) were added to the function, and the following was estimated:

$$rm_t = \beta_1 Y^*_t + \beta_2 \Delta Y^*_t + \beta_3 \Delta M^*_t + \sum_{i=o}^{n} \alpha_{i+1} \dot{P}_{t-i}$$

The first two terms on the right determine the equilibrium interest rate (re_t). The real-balances term yields the deviation of real market rates from equilibrium, and the last term captures the price expectation effect.

Quarterly data were used, and real GNP served to measure real output. The annual rate of change of the GNP deflator was used to measure price movements and also to deflate the quarterly changes in the stock of money. Table IV compares these results with the earlier regressions which included only prices as arguments.

The first set of regressions in Table IV apparently has not overstated the total effect of price movements on long-term interest rates, as the sums of the α_i coefficients are unchanged in the more completely specified functions. Current and most recent price changes apparently captured some of the effect of contemporaneous output and changes in real balances, however, since the mean lag is more than twice as long in the second set of regressions.

There appears to be some merit in the more extensive specifications. However, inclusion of the additional variables did not drastically alter the conclusions of the original regressions. The mean lag, while longer, is still much shorter than other studies have found. In addition, the real market rates implied by each set of regressions are very similar and suggest that price expectations account for a great deal of the movement in nominal rates since 1961.

Table IV

SUMMARY OF REGRESSIONS

(Quarterly data, 1961-69)

$$rn^L_t = \alpha_o + \alpha_1 \dot{P}_t + \alpha_2 \dot{P}_{t-1} + \ldots + \alpha_{n+1} \dot{P}_{t-n}$$

n	$\sum_{i=0}^{n} \alpha_{i+1}$	mean lag	α_o	R^2
16	.8031	3.1	3.3539	.9768
20	.7988	3.0	3.3589	.9767
24	.7934	3.1	3.3762	.9764

$$rn^L_t = \beta_1 Y^*_t + \beta_2 \Delta Y^*_t + \beta_3 \Delta M_t + \alpha_1 \dot{P}_t + \alpha_2 \dot{P}_{t-1} + \ldots + \alpha_{n+1} \dot{P}_{t-n}$$

n	$\sum_{i=0}^{n} \alpha_{i+1}$	mean lag	β_1	β_2	β_3	R^2
16	.7851	8.6	.0058	.0082	—.0998	.9736
20	.8038	8.1	.0056	.0098	—.0778	.9744
24	.8335	7.7	.0054	.0091	—.0674	.9764

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

FEDERAL RESERVE SYSTEM ACTIONS DURING 1969

Federal Reserve Credit

	Annual Rates of Change	
	12/68 to 11/69 p.	12/67 to 12/68
Federal Reserve Holdings of Government Securities	8.3	7.4
Federal Reserve Credit	5.1	10.2
Total Reserves of Member Banks	−2.3	7.8
Monetary Base	3.2	6.5
Reserves Available for Private Demand Deposits	−1.7	7.0

p. - preliminary

Discount Rate (FRB St. Louis)

In effect January 1, 1969	5½%
April 4, 1969	6
In effect December 15, 1969	6

Reserve Requirements[1]

	Percentage Required					
	Net Demand Deposits up to $5 Million		Net Demand Deposits in Excess of $5 Million		Time Deposits up to $5 Million & Savings Deps.	Time Deposits in excess of $5 mil.
	Reserve City Banks	Other Member Banks	Reserve City Banks	Other Member Banks		
In effect Jan. 1, 1969	16½	12	17	12	3	6
April 17, 1969	17	12½	17½	13		
In effect Dec. 15, 1969	17	12½	17½	13	3	6

Margin Requirements on Listed Stocks

In effect January 1, 1969	80%
In effect December 15, 1969	80%

Maximum Interest Rates Payable on Time & Savings Deposits

Type of Deposit	In effect Jan. 1, 1969	In effect Dec. 15, 1969
Savings Deposits	4%	4%
Other Time deposits:		
Multiple maturity:		
90 days or more	5	5
Less than 90 days	4	4
Single maturity:		
Less than $100,000	5	5
30-59 days	5½	5½
60-89 days	5¾	5¾
90-179 days	6	6
180 days and over	6¼	6¼

[1]Beginning October 16, 1969, a member bank is required under Regulation M to maintain, against its foreign branch deposits, a reserve equal to 10 per cent of the amount by which (1) net balances due to, and certain assets purchased by, such branches from the bank's domestic offices, and (2) credit extended by such branches to U. S. residents exceed certain specified base amounts. Regulation D imposes a similar 10 per cent reserve requirement on borrowings by domestic offices of a member bank from foreign banks, except that only a 3 per cent reserve is required against such borrowings that do not exceed a specified base amount.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

REVIEW INDEX — 1969

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis