FEDERAL RESERVE BANK OF ST. LOUIS

JANUARY 1971

REVIEW

CONTENTS

Vol. 53, No. 1

Current Stabilization Policy

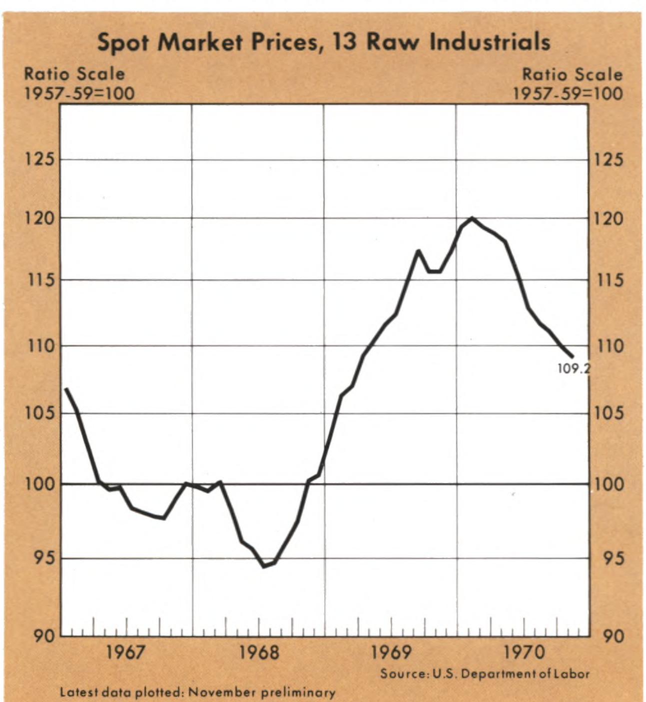
THE NATIONAL ECONOMY is confronted with two major problems — inflation and unemployment — and for the first time since 1957 and 1958 both problems must be dealt with simultaneously. The course of events which brought the economy to this juncture includes the monetary and fiscal actions of the past five years.

Until mid-1970, rising unemployment did not appear to many analysts to be a major problem for the economy. The rise of unemployment in the first half of 1970, compared to 1969, was viewed as a temporary effect of a moderated growth of total demand and as a necessary cost of establishing price stability. It was recognized that a somewhat higher and gradually rising level of unemployment was to be expected for a short time, as a result of applying more restrictive stabilization actions in hopes of achieving a relatively stable price level. By the autumn of 1970, however, unemployment had risen more than most analysts expected.

Recent Developments

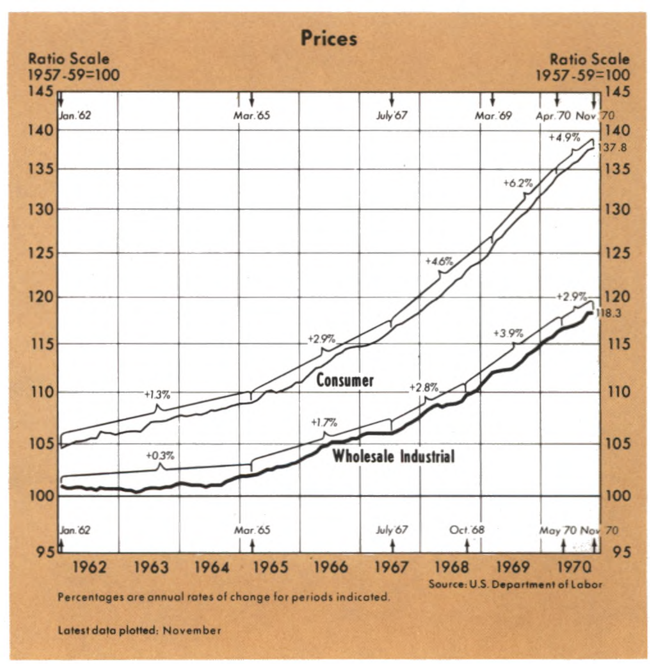
Recent Price and Employment Trends

The gradual moderation of the pace of price increases in 1970 was similar to price trends during other post World War II periods when the growth of total spending slowed. The growth rate of raw industrial material prices rose steadily in the last half of 1968 and 1969, reaching a peak in 1970. The growth of wholesale industrial prices and consumer prices reached peaks in the first half of 1970.



Since February 1970, the prices of raw industrial materials have declined at an 11.7 per cent annual rate. While these prices are highly responsive to changing demand and supply conditions, their decline should not be viewed as conclusive evidence that substantial improvement in inflation will follow. The decline reflects international as well as domestic market conditions.

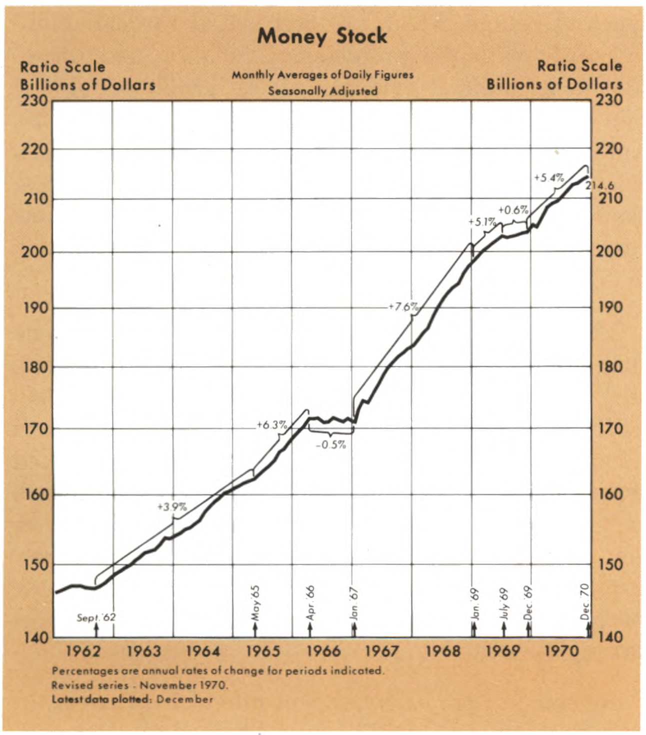
Wholesale prices of industrial commodities rose at a 3 per cent annual rate from May to December, down from the 3.9 per cent increase in the preceding twelve months. Wholesale prices of farm products and processed foods and feeds declined slightly over the year ending in December, but these prices frequently reflect special supply conditions, and for short periods of time often follow trends independent of business fluctuations in the economy. Consumer prices have moderated since last April, rising at a 4.9 per cent annual rate to November, compared with a 6 per cent increase in the previous twelve months.



Slower growth in total spending and a growing labor force resulted in a rising unemployment rate in 1970. Unemployment reached 6 per cent of the labor force in December, compared with a 3.9 per cent rate in January 1970. The average duration of unemployment increased from approximately 7.8 weeks late in 1969 to 9.2 weeks in the last quarter of 1970.

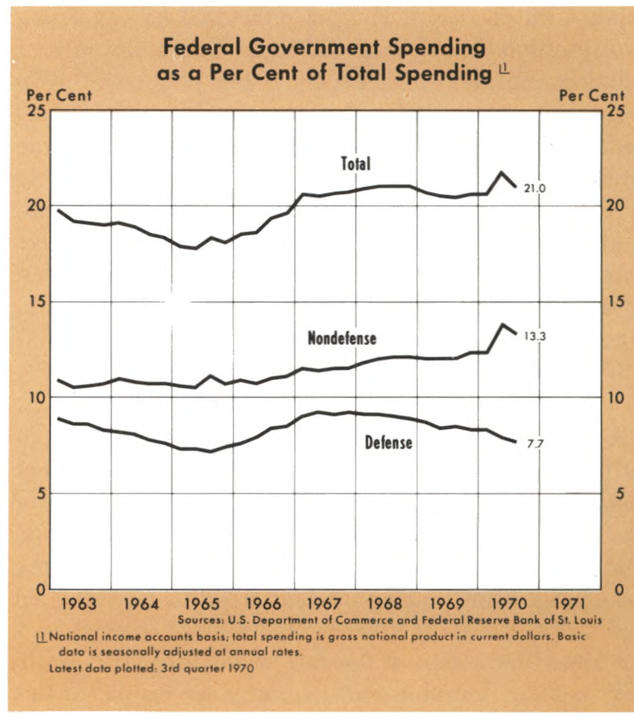
Monetary and Fiscal Developments

The money stock rose 5.4 per cent from December 1969 to December 1970, compared with 3 per cent in 1969.[1] In 1967 and 1968, when inflationary pressures were intensifying, money expanded at about a 7.2 per cent annual rate. Time deposits have increased at a rapid 23 per cent rate since February, to a large extent the result of reintermediation associated with the substantial decline in market interest rates this year, and relaxation of Regulation Q ceilings on the rates banks were permitted to pay on time deposits.



Several budget actions in 1970 contributed to increases in disposable personal income. A 6 per cent pay increase for Federal employees and an increase in the Social Security benefit schedule were enacted into law, both retroactive to the beginning of the year. The tax surcharge was reduced to 5 from 10 per cent on January 1, 1970, and expired on June 30. These actions, together with lower-than-anticipated tax receipts associated with the economic slowdown, resulted in a swing in the national income accounts budget from a surplus of $9.3 billion in the calendar year 1969 to a deficit at an $11.9 billion annual rate in the third quarter of 1970.

Federal budget trends and priorities of the past decade can be seen in the accompanying chart. Total Federal spending increased from 18 per cent of total spending in 1965 to an average of 21 per cent for the years 1967 to 1970. Government spending for defense and defense-related programs increased from 7 per cent of total spending in 1965 to 9 per cent in 1968, and then declined to slightly less than 8 per cent in 1970. Since 1968, nondefense spending as a proportion of total spending in the economy has expanded by an amount slightly greater than the decline in defense spending as a proportion of total spending, so that total Federal spending in 1970 were slightly higher than in 1969.



Policy Dilemma

The problems facing stabilization authorities are substantially different now than a year ago. At the end of 1969 there was little question that inflation was the most important problem facing economic policymakers. A year later the rate of price increase (as

[1]See "The Revised Money Stock: Explanation and Illustrations" on pages 6-15 of this *Reveiw,* for a discussion of the recent revisions of money stock data.

measured by the GNP implicit price deflator) had declined to about a 4.5 per cent annual rate, while unemployment as a per cent of the civilian work force had risen from 3.5 per cent to 6 per cent.

Few economic analysts would argue that the effort to eliminate inflation should be abandoned to give full attention to preventing further increases in unemployment. Similarly, few analysts would propose that the level of unemployment should be disregarded and that any amount of idle work force should be allowed to occur, while the remaining forces of inflation are purged from the economy. The approach to economic stabilization taken in view of these circumstances will depend on the consensus of policymakers regarding two questions: how long will it be before the rate of inflation subsides substantially if the policies of 1970 are continued in 1971; and what will be the likely path of the unemployment rate in the interim? If the time span required to stem inflation is considered to be too long, or the contemplated average level of unemployment is deemed to be too great, alternative policies would be recommended by some. However, an assessment of the most probable results of continuing recent past policies should be made, before alternative courses are proposed.

A position which favors continuing the policies of 1970 is based to some extent upon the assumption that people still anticipate rapid inflation, on the basis of the last five years of inflation. Further, it is argued that the current slowdown in business activity and the associated rising unemployment were to be expected and were necessary in order to eventually achieve a continued reduction of the rate of inflation. It is probably neither desirable nor necessary, according to this view, to reduce the rate of growth of total demand for goods and services in the future below the rate of 1970. A substantial and prolonged increase in the growth of total spending from the present rate, initiated by expansive monetary and fiscal actions, would preclude further progress in controlling inflation.

A second position, which favors emphasizing a reduction in unemployment as the primary objective of stabilization policy, argues that stabilization actions to stimulate total spending would promptly accelerate the growth of production and employment. Since there currently exists excess labor and capital equipment, it is argued that such stimulation would result in little interruption in the rate of price decline. Only when the gap between actual and potential output is substantially narrowed, it is contended, would there be a danger of adding to inflationary forces.

The difference between these positions depends on the weighting of economic objectives and the choice of a time horizon in which to achieve the objectives. If a decline in unemployment is the dominant, but not the exclusive, objective of stabilization policy, the goal of relative price stability will probably have to be sacrificed in the near-term. If the reduction of inflation is the dominant, but not the exclusive, objective of policy, a quicker reduction in inflation might be obtained at the expense of temporarily higher unemployment.

There is little direct historical evidence as to the types of actions which are best suited to deal simultaneously with the problems of inflation and unemployment. Indirect evidence of the likelihood of certain outcomes of various policy alternatives, however, can be obtained from statistical studies of historical relationships among economic magnitudes. Implications from such studies indicate the most probable response of the economy to alternative stabilization actions.

The results of recent studies by this Bank indicate that a growth of the money stock at a 5 per cent rate in 1971 would imply a 7 per cent increase in nominal GNP for the four quarters of 1971. A price rise of about 4 per cent and an unemployment rate of about 6 per cent would be associated with this rate of growth of total spending during 1971. Beyond 1971, a continuation of a 5 per cent rate of growth of money would be conducive to further reduction in the rate of inflation and some improvement in the level of unemployment.

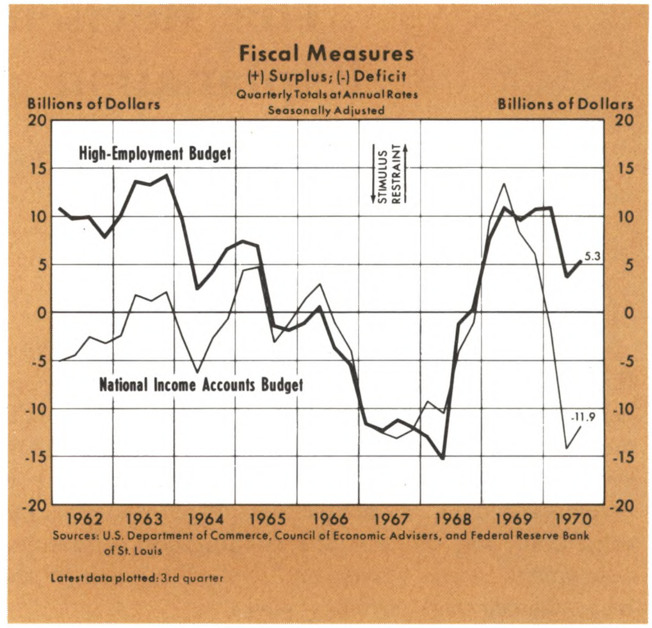
By comparison, an 8 per cent rate of increase in the money stock during 1971 most likely would be associated with about a 9 per cent rate of growth of total spending, a 4.4 per cent rate of increase in prices, and a 5.7 per cent unemployment rate. The rate of inflation would remain high beyond 1971, even if a slower growth in money were sought after 1971.

Strategies for Policy in 1971

Some persons who desire "full" employment within the next year or two have suggested that it would be desirable for real output to rise at about an 8 per cent annual rate until full employment is achieved. It is doubtful that this goal is attainable, given the current state of the economy and the lagged effects of past actions. Moreover, such a rapid expansion would probably revive expectations of rapid inflation, which would cause substantial problems for stabilizing the price level in the future. The course suggested to attain the 8 per cent real growth would be to maintain or accelerate the growth in Federal expenditures, which would result in a $15 to $20 billion budget (NIA) deficit in 1971 (but a near balance on the high-employment accounts budget). The deficit might be financed, in large part, by a more rapid monetary expansion.

This expansive policy has appeal for those with short time horizons for evaluation. However, when judgment includes the effects beyond the present year or so, the more expansionary course is not so clearly desirable. The more moderate course, of continuing through 1971 to expand the money stock at about the same rate achieved in 1970, would be conducive to continued reduction in the rate of inflation while allowing a resumption in the growth of real product.

Inflation and inflationary expectations should continue to have a bearing on stabilization policy, although this concern is likely to be tempered by greater attention to unemployment than was the case only three or four months ago. Relaxation of stabilization policies and resulting increased growth in spending will cause a lengthening of the waiting period necessary to stem inflation. If the relaxation is great, substantial spending increases may cause further inflation, with employment benefits and increased growth of real output only temporary.



The Revised Money Stock: Explanation and Illustrations[1]

by ALBERT E. BURGER and JERRY L. JORDAN

THE BOARD OF GOVERNORS of the Federal Reserve System recently revised the data for currency held by the public, demand deposits held by the public, and time deposits at all commercial banks. The revision includes semi-annual adjustments for new benchmark data on nonmember bank deposits and vault cash, and the annual recomputation of seasonal adjustment factors which are applied to each of the basic deposit and currency series.

In addition to the semi-annual benchmark and annual seasonal adjustments, a major aspect of the present revision is the correction of a measurement error in member bank demand deposits adjusted. This measurement error resulted mainly from international financial transactions flowing through U. S. agencies and branches of foreign banks, and subsidiaries of U. S. banks organized under the Edge Act to engage in international banking.[2]

This note explains the revisions, illustrates their effect on the level and growth rates of money, and analyzes their significance for assessing recent monetary actions and their influence on the economy. In the Appendix, a sequence of transactions involving Edge Act corporations are presented in T-accounts to show how the money stock series was underestimated.

Reasons for the Revision

Seasonal Factors

Most weekly, monthly, and quarterly economic time series are subject to recurrent seasonal movements which are not related to broader underlying trends. In order to analyze movements in the series free of seasonal movements, statisticians have devised methods of identifying seasonal patterns and computing factors which are used to adjust the raw data. The seasonal pattern for a given series may change over time for various reasons, so it is desirable to recompute periodically the seasonal adjustment factors. The seasonal factors for components of the money supply and related series are recomputed annually.

Benchmark Adjustments

Twice each year insured nonmember banks submit their Reports of Condition (call reports) to the Federal Deposit Insurance Corporation. From these reports the Federal Reserve obtains information on nonmember bank deposits and vault cash. Between such reports the nonmember bank data on vault cash and deposits are estimated for purposes of computing the money stock. The receipt of new call report data provides a "benchmark" for improving the estimated nonmember bank data. Benchmark adjustments revised estimated nonmember bank deposits downward by $300 million at the end of 1969 and by $900 million for mid-1970.

Revisions in Demand Deposit Calculations

The U. S. money supply series, as compiled and published by the Federal Reserve System, consists of currency in the hands of the public and demand deposits held by the public at all commercial banks. The currency component of the money supply is obtained by subtracting vault cash of all commercial banks from total currency in circulation.[3]

[1]The discussion in this note regarding the effects of transactions involving Edge Act corporations has benefited significantly from discussions with and papers made available by Irving Auerbach at the Federal Reserve Bank of New York and Edward R. Fry at the Board of Governors of the Federal Reserve System. Mr. Auerbach, Mr. Fry, and their respective associates are absolved of any remaining errors. For further discussion of the magnitude of the underestimation of the old money series, and the procedures used in the revision to correct for these measurement errors, see "Revision of the Money Stock," Federal Reserve *Bulletin*, December 1970, pp. 887-909.

[2]The Edge Act of 1919 amended the Federal Reserve Act permitting the Federal Reserve Board to charter corporations "for the purpose of engaging in international or foreign banking or other international or foreign financial operations . . . either directly or through the agency, ownership, or control of local institutions in foreign countries. . . ."

[3]Data for vault cash of member banks are available on a weekly basis to the Federal Reserve. Data for vault cash of nonmember banks are estimated between semi-annual call reports. Data for total currency in circulation are available daily from Treasury and Federal Reserve statements.

The demand deposit component of the money supply includes only demand deposits held by the nonbank public, that is, demand deposits at all commercial banks other than those due to domestic commercial banks (interbank demand deposits) and the U.S. Government. Also, "cash items in process of collection" and Federal Reserve float are deducted, to avoid double counting in measuring the amount of demand deposits the nonbank public *knows* that it holds (and hence influences spending decisions).

The reason for deducting cash items in process of collection between domestic commercial banks can be illustrated by an example:

> Suppose Mr. A writes a check for $100 on his commercial bank (CB_a). He then gives the check to Mr. B who deposits it in his bank (CB_b). While the check is in process of collection, that is, while CB_b is waiting to receive a transfer of reserves from CB_a, the funds involved appear as a demand deposit on the books of both CB_a and CB_b. Since checks do not clear instantaneously, gross demand deposits temporarily rise by $100.
>
> The money supply series measures the currency and demand deposits which the public *knows* it holds. Mr. A knows that he has $100 less in his checking account. Therefore, the cash item in process of collection (the $100 check of Mr. A) is deducted to get a more accurate measurement of the money supply series.

"Cash items" (which appear as asset items in the balance sheets of banks waiting to receive payment) are also generated by certain international transactions. To the extent that the cash items resulting from the collection of funds relating to an international transaction (for example, the borrowing and repayment of Eurodollars)[4] are matched by a liability such as a demand deposit of a foreign corporation, the computation of the demand deposit component of the money supply is the same as for cash items arising from purely domestic clearings.

However, certain other international transactions — involving Edge Act corporations and U. S. agencies and branches of foreign banks — may not give rise to deposit liabilities on domestic commercial banks to offset the international cash items generated on the domestic commercial banks' balance sheet.[5] A deposit of an Edge Act corporation or similar institution is treated by a U. S. bank as an interbank deposit and is therefore not included in the demand deposit component of the money supply.[6] However, the cash items generated by the Edge Act transactions are included in the bank's total cash items, which are deducted from gross demand deposits.

The following example illustrates the effect of this treatment of Edge Act deposits on the money supply.

> When a U. S. bank receives a check to be credited to the account of an Edge Act corporation, the bank enters the amount of the check in a liability account "due to bank" and also adds the amount to cash items in process of collection. When computing the money supply data, both the cash item and the "due to" account are deducted from gross demand deposits. The deduction of cash items is only appropriate when there is a counterpart deposit in the money supply data. Hence, it is double subtracting to include the cash item temporarily created by this transaction in the total cash items in process of collection to be deducted from gross demand deposits.

The volume of international transactions which creates these particular "due to" or interbank deposit accounts has been increasing rapidly in recent years. Thus, the old money supply series was subject to an increasing underestimation.

To correct for this measurement error in the demand deposit component of the money stock, data were collected from U. S. agencies and branches of foreign banks, and from Edge Act corporations, and added to gross member bank demand deposits.[7] As a result, the deduction of total cash items in process of

---

[4]See Albert E. Burger, "Revision of the Money Supply Series," this *Review*, October 1969, pp. 6-9, and "Revision of the Money Supply Series," Federal Reserve *Bulletin*, October 1969, pp. 787-803, for discussions of the effects of Eurodollar transactions on the money supply prior to mid-1969, and a description of changes in Regulation D to require certain transactions to be treated the same as other deposits subject to reserve requirements.

[5]The discussion in this article will emphasize transactions involving Edge Act corporations, but the reader should be aware that the discussion applies to certain other types of international institutions as well.

[6]This is the same as the liability account "due to domestic commercial banks" that appears on the balance sheet of a large correspondent bank with which another bank maintains deposits for clearing purposes (see Table I). These transactions do not affect the required reserves of the commercial bank. The "due to" account increases the bank's demand deposits subject to reserve requirements, but the corresponding "cash item" is subtracted, thus demand deposits subject to reserve requirements are not affected.

[7]According to the article, "Revision of the Money Stock," Federal Reserve *Bulletin*, December 1970, p. 891: "The figures for deposits of Edge Act corporations are readily available from weekly reports submitted to the Federal Reserve Bank of New York in accordance with Regulation K. For agencies and branches of foreign banks, end-of-month deposit figures are available from reports submitted to the New York State Commissioner of Banking. However, it was necessary to

collection (including those created by both domestic and international transactions) now provides a more accurate measure of "member bank demand deposits adjusted."[8]

Computation of the demand deposit component of the money supply for a sample week is illustrated in Table I. Although the data in the table are approximations of the actual dollar changes, they reflect accurately the relative sizes of the revisions resulting from international transactions relative to benchmark adjustments. In the sample week, the addition of gross deposit liabilities of Edge Act corporations and other international banking institutions raised demand deposits adjusted by $7.9 billion. Data for nonmember bank deposits, based on new benchmark data, were revised downward by $1.2 billion. The net of these two corrections raised the demand deposit component of the money supply (before seasonal adjustment) by $6.7 billion in the sample week.

Table I

Computation of Demand Deposit Component of Money Supply[1]

	Old Series	Revised Series	Effective Change
Gross demand deposits (member banks)	$179.1	same	
PLUS:			
Demand deposits due to mutual savings banks and foreign institutions	3.0	same	
Liabilities of specialized banking institutions[2]	—0—	7.9	+ 7.9
LESS:			
Demand deposits due to banks[3]	23.8	same	
U.S. Government demand deposits	5.9	same	
Cash items in process of collection	31.5	same	
Demand deposits adjusted (member banks)	$120.9	$128.8	+$7.9
PLUS:			
Nonmember bank demand deposits adjusted	38.3	37.1	− 1.2[4]
Foreign and international deposits at Federal Reserve	0.4	same	
LESS:			
Federal Reserve float	3.0	same	
Total demand deposit component	$156.6	$163.3	+$6.7

[1]Data are in billions of dollars, not seasonally adjusted.

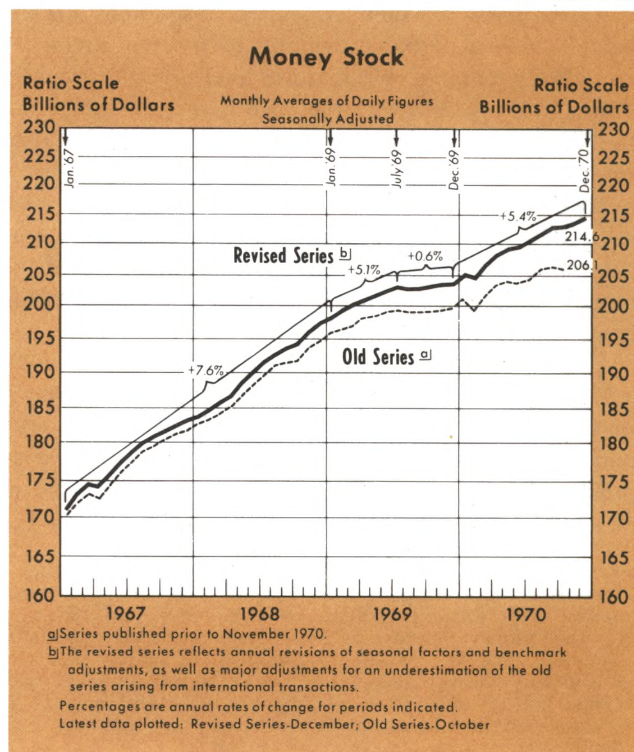
[2]Represents liabilities of Edge Act corporations and foreign agencies. These liabilities are counterparts to certain cash items on the books of domestic commercial banks. They are included to neutralize the downward effect in money supply calculations of an equivalent amount of cash items on the books of commercial banks, which are subtracted from gross demand deposits. Because foreign agencies and Edge Act corporations are now treated as part of the commercial banking system, a small amount of deposits held more or less permanently by their customers is also added to the demand deposit component of the money supply.

[3]Consists of all interbank deposits including deposits due to Edge Act corporations and foreign agencies.

[4]Benchmark adjustment.

Magnitude of the Revisions: Levels and Growth Rates of Money

The accompanying chart of monthly data for the "revised" and the "old" money supply series from 1967 to the present illustrates the effects of the recent revisions.[9] Underestimation of the old money supply series has been building up since mid-1968, and has widened more rapidly since mid-1969. However, comparison of the levels of the old and revised money supply data would not provide an accurate assessment of the effects of the recent revision on the influence of monetary actions in the past few years. Empirical



obtain additional data from agencies and branches to allow for checks written by them that were making for inappropriate cash items as a result of the intermediary role of these institutions in international transfers. Such data have been reported daily since October 1 and will be available on a continuing basis."

[8]Two other much smaller sources of understatement of demand deposits resulting from banks' practices in accounting for Eurodollar repayments were identified and eliminated by a change in accounting practices of certain banks.

[9]The recently revised money supply data are referred to as the "revised money supply series," and the former data are referred to as the "old money supply series" only as an aid to exposition in this article.

Table II

REVISED MONEY SUPPLY
COMPOUNDED ANNUAL RATES OF CHANGE

TERMINAL MONTH \ INITIAL MONTH	5-69	6-69	7-69	8-69	9-69	10-69	11-69	12-69	1-70	2-70	3-70	4-70	5-70	6-70	7-70	8-70	9-70	10-70	11-70	BILLIONS OF DOLLARS
6-69	4.9																			202.4
7-69	4.5	4.2																		203.1
8-69	2.0	0.6	-2.9																	202.6
9-69	1.8	0.8	-0.9	1.2																202.8
10-69	1.9	1.2	0.2	1.8	2.4															203.2
11-69	1.9	1.3	0.6	1.8	2.1	1.8														203.5
12-69	1.7	1.2	0.6	1.5	1.6	1.2	0.6													203.6
1-70	2.7	2.4	2.1	3.1	3.6	4.0	5.1	9.8												205.2
2-70	1.9	1.6	1.2	1.9	2.0	1.9	2.0	2.7	-4.0											204.5
3-70	3.0	2.8	2.6	3.4	3.8	4.1	4.6	6.0	4.2	13.0										206.6
4-70	3.6	3.5	3.4	4.2	4.7	5.1	5.8	7.1	6.2	11.7	10.3									208.3
5-70	3.8	3.7	3.6	4.4	4.8	5.1	5.7	6.7	6.0	9.5	7.8	5.3								209.2
6-70	3.7	3.6	3.5	4.2	4.5	4.8	5.2	6.0	5.2	7.7	5.9	3.8	2.3							209.6
7-70	3.8	3.7	3.7	4.3	4.6	4.9	5.3	6.0	5.3	7.3	5.9	4.5	4.1	5.9						210.6
8-70	4.0	4.0	3.9	4.5	4.9	5.1	5.5	6.1	5.6	7.3	6.1	5.1	5.1	6.5	7.1					211.8
9-70	4.1	4.1	4.1	4.6	4.9	5.2	5.5	6.1	5.6	7.1	6.1	5.3	5.3	6.2	6.4	5.8				212.8
10-70	4.0	3.9	3.9	4.4	4.6	4.8	5.1	5.6	5.1	6.3	5.4	4.6	4.4	4.9	4.6	3.4	1.1			213.0
11-70	3.9	3.8	3.8	4.3	4.5	4.7	4.9	5.3	4.9	5.9	5.1	4.3	4.2	4.5	4.2	3.2	2.0	2.9		213.5
12-70	4.0	4.0	4.0	4.4	4.6	4.8	5.0	5.4	5.0	6.0	5.2	4.6	4.5	4.8	4.6	4.0	3.4	4.6	6.4	214.6
	5-69	6-69	7-69	8-69	9-69	10-69	11-69	12-69	1-70	2-70	3-70	4-70	5-70	6-70	7-70	8-70	9-70	10-70	11-70	

INITIAL MONTH

OLD MONEY SUPPLY
COMPOUNDED ANNUAL RATES OF CHANGE

TERMINAL MONTH \ INITIAL MONTH	3-69	4-69	5-69	6-69	7-69	8-69	9-69	10-69	11-69	12-69	1-70	2-70	3-70	4-70	5-70	6-70	7-70	8-70	9-70	BILLIONS OF DOLLARS
4-69	8.2																			198.1
5-69	4.7	1.2																		198.3
6-69	4.5	2.8	4.3																	199.0
7-69	3.9	2.4	3.1	1.8																199.3
8-69	2.7	1.4	1.4	0.0	-1.8															199.0
9-69	2.2	1.1	1.1	0.0	-0.9	0.0														199.0
10-69	2.0	1.0	1.0	0.2	-0.4	0.3	0.6													199.1
11-69	1.9	1.0	1.0	0.4	0.0	0.6	0.9	1.2												199.3
12-69	1.9	1.1	1.1	0.6	0.4	0.9	1.2	1.5	1.8											199.6
1-70	2.6	2.0	2.1	1.8	1.8	2.6	3.2	4.1	5.5	9.4										201.1
2-70	1.4	0.7	0.7	0.2	0.0	0.3	0.4	0.3	0.0	-0.9	-10.2									199.3
3-70	2.4	1.9	1.9	1.7	1.7	2.2	2.5	2.9	3.3	3.9	1.2	14.1								201.5
4-70	3.0	2.6	2.8	2.6	2.7	3.3	3.7	4.3	4.9	5.7	4.4	12.7	11.3							203.3
5-70	3.1	2.7	2.8	2.7	2.8	3.3	3.7	4.2	4.7	5.2	4.2	9.6	7.4	3.6						203.9
6-70	2.8	2.4	2.5	2.3	2.4	2.8	3.1	3.4	3.7	4.0	3.0	6.6	4.2	0.9	-1.8					203.6
7-70	2.8	2.5	2.6	2.5	2.5	2.9	3.2	3.5	3.8	4.1	3.2	6.1	4.2	2.0	1.2	4.2				204.3
8-70	3.3	3.0	3.1	3.0	3.1	3.5	3.8	4.2	4.5	4.8	4.2	6.8	5.4	4.0	4.2	7.3	10.5			206.0
9-70	3.2	2.9	3.0	2.9	3.0	3.3	3.6	3.9	4.2	4.4	3.8	6.0	4.7	3.5	3.4	5.2	5.7	1.2		206.2
10-70	2.9	2.6	2.7	2.6	2.7	3.0	3.2	3.5	3.7	3.9	3.3	5.1	3.9	2.7	2.5	3.6	3.4	0.0	-1.2	206.0
	3-69	4-69	5-69	6-69	7-69	8-69	9-69	10-69	11-69	12-69	1-70	2-70	3-70	4-70	5-70	6-70	7-70	8-70	9-70	

INITIAL MONTH

studies provide evidence that, for purposes of assessing the impact of monetary developments on the economy, it is appropriate to look at the changes in the rate of growth of money over the past twelve or more months.

The growth rates of money indicated by the revised series for 1968 and 1969 are not sufficiently greater than the respective growth rates indicated by the old series to warrant reassessment of the influence of monetary actions during those two years. The growth of money in 1968 (from IV/67 to IV/68) was at a 7.4 per cent annual rate for the revised series, compared with a 6.8 per cent rate in the same period for the old series. Similarly, the revised money series rose at a 3.8 per cent rate from IV/68 to IV/69, not much faster than the 3.1 per cent rate of increase of the old series in that period.

The significance of the recent money supply revisions depends upon the impact of the revisions on the rates of change of money during 1969 and 1970. Table II contains two "rate-of-change triangles" showing the growth rates of the revised and the old money supply series from various initial months to various terminal months in 1969 and 1970. To read the triangles, observe that the rate of change of the revised money supply series *from* December 1969 (on top and bottom horizontal axis) *to* May 1970 (on left vertical axis) was 6.7 per cent. The rate of change of the old money series in the same period was 5.2 per cent. With the aid of these triangles, the reader can choose any beginning and ending month he considers relevant, and compare the impact of the recent revisions on the growth rates of money.

Revision of Money and Assessment of the Influence of Monetary Actions on GNP

An Analytical Approach

It is useful to employ a consistent analytic framework to analyze the implications of the revised money supply series on the implied course of total spending. Such an analytic framework is available in which changes in gross national product are statistically related to current and lagged changes in the money supply and high-employment Government expenditures.[10]

After obtaining a historical relation between changes in GNP on the one hand, and changes in money and Government expenditures on the other, it is possible to estimate the changes in GNP which are implied for the future under alternative assumed growth rates of money. The same assumptions about future Government expenditures are employed in each case, and it is assumed that there is no difference in other factors that influence GNP. In such illustrations, the *relative sizes* of the projected changes in GNP under various assumptions concerning the future growth rate of money are important. The absolute level and the changes in the projected values for GNP are naturally subject to many factors not provided for in this procedure, such as the duration of an automobile industry strike.

Monetary Actions in 1970

As noted above, the growth rates of money for 1968 and 1969, according to the revised series, were not much greater than the rates indicated by the old series. Consequently, assessment of the thrust of monetary actions during those two years is little affected by availability of the revised series as opposed to the old series.

The effect of one's assessment of the thrust of monetary actions in 1970 bears closer analysis. From IV/69 to III/70 the growth of money was indicated by the old series to have been at a 4.2 per cent annual rate, and is now shown to have been at a 5.5 per cent rate by the revised series. A relevant question to pose at this point is whether one's conclusion about the influence of monetary actions on the future growth of total spending, and hence prices and unemployment, would be much affected by the availability of the revised series.

By employing this approach, it is possible to test whether the growth rate of money for 1970 that appeared most likely to achieve a given growth rate of total spending would have been different at the end of 1969, if the revised money series had been available at that time. Using statistical relations estimated from data available through the end of 1969, projections were made of the growth paths of GNP for the four quarters of 1970 based on alternative assumed (constant) growth rates of the revised money series. These projections were then compared with similar projections based on the same assumed growth rates of the old money supply series.[11]

---

[10]See Leonall Andersen and Keith Carlson, "A Monetarist Model for Economic Stabilization," this *Review*, April 1970, pp. 7-25, for discussion of a procedure whereby alternative constant rates of growth of money are used to simulate the relative impacts on projections of various measures of economic activity.

[11]Specifically, data for quarter-to-quarter changes in the old series from 1953 through 1969 were used to estimate a statistical relationship with quarter-to-quarter changes in GNP in the same period. Next, alternative assumptions about the growth rate of money during 1970 were used to

The results were very close between each growth rate for the two series, indicating that the availability of the revised series at the end of 1969 would not have influenced substantially the selection of the desired growth of money for 1970. For example, based on the actual growth of the revised series during 1969 and an assumed constant 5 per cent rate of growth of this series during 1970, the growth of GNP was indicated to be 6.1 per cent from IV/69 to IV/70. This compares with a 5.8 per cent growth of GNP for the same period as indicated by the actual growth of the old series in 1969 and an extrapolation of that series at a 5 per cent rate for 1970.

It now appears that the actual growth of GNP during 1970 was somewhat less than 5 per cent. A 5 per cent rate of growth of either money series indicated a faster GNP growth during 1970. However, it should not be surprising that the actual growth of GNP fell short of the projections based on 5 per cent growth of money. The actual growth of GNP in the second half of 1970 was substantially dampened by the automobile industry strike, but, since there is no provision for the effects of a strike in this procedure, the actual should be less than the projected. Furthermore, the procedure is based on historic average relationships between changes in GNP and changes in money and Government expenditures during a period (from 1953) in which there have been several "business cycles" of varying lengths and degrees of severity.

Monetary Actions in 1971

Table III shows the projected quarterly changes in GNP from IV/1970 to IV/1971 as calculated for the revised money series and for the old series (based on data available through III/70). A 5 per cent annual rate of increase was assumed in the respective money supply series from III/70 to IV/71.

Table III

PROJECTED CHANGES IN GNP
Using the Revised Money Supply Series and the Old Series[1]

	Annual Rates of Change	
	Revised Series	Old Series
III/70 (Actual)	(6.1%)	
IV/70	6.4%	5.4%
I/71	6.3	5.9
II/71	6.3	6.4
III/71	8.9	9.2
IV/71	6.0	6.3
	Dollar Change from Previous Quarter[2]	
	Revised Series	Old Series
III/70 (Actual)	($14.4)	
IV/70	$15.4	$12.9
I/71	15.4	14.3
II/71	15.5	15.7
III/71	22.2	23.0
IV/71	15.4	16.1

[1]Projected using first differences of money and high employment Government expenditures. The annual growth of money is assumed to be 5 per cent from III/70 to IV/71. Expenditures are estimated through II/71, and thereafter are projected at a 6 per cent rate.

[2]Billions of dollars at annual rates.

The table shows that GNP projections for IV/70 and I/71, obtained using the revised money supply series, are higher than those obtained using the old money supply series. The GNP projections based on the old series for these two quarters are strongly influenced by the relatively slower growth of money in 1970 indicated by the old series. The GNP projections for the period from the fourth quarter of 1970 through the end of 1971, using a 5 per cent growth rate of either money supply series, are approximately the same.

The revision of the money supply data has permitted a reassessment of the predicted strength of economic activity in the near future. However, the revision has not had a noticeable influence on predictions of the effects of monetary growth on economic activity over the coming year. On balance, if the goals of policy have remained unchanged, the comparisons presented here do not support any conjecture that monetary actions in the near future should be altered substantially from actions that were deemed appropriate based on the old series.

This article is available as Reprint No. 62.

obtain quarter-to-quarter changes in money for 1970, beginning from the actual level of money (old series) in the fourth quarter of 1969. These assumed changes in money in 1970 were then used, together with actual changes for money in 1969, to compute the projections of GNP for 1970 implied by each alternative growth rate of the old money series during 1970. Finally, the entire procedure was repeated using actual changes in the revised money through 1969 to estimate a statistical relation with changes in GNP for the period, and to make projections for 1970.

The Appendix to this article begins on the next page.

APPENDIX

The following Appendix provides a technical analysis of how transactions involving Edge Act corporations caused an underestimation of the money stock series prior to the November 1970 revision. The example transactions used in this analysis should be viewed as a typical sequence of entries which would affect the measurement of the money stock.

The examples used draw heavily on a paper by Irving Auerbach of the Federal Reserve Bank of New York: "Edge Act Corporations: Some Problems For U.S. Banking and Monetary Statistics."

The purpose of this Appendix is to illustrate, through the use of "T - accounts," the type of transactions involving Edge Act corporations which have resulted in an understatement of the money stock. A key to understanding the examples used is to remember that one asset account of commercial banks (Cash Items in the Process of Collection) and one liability account (Due to Banks) are both deducted from the banks' gross (total) demand deposits in order to obtain the demand deposit component of the money stock. Also, demand deposits of foreigners at U.S. commercial banks, whether foreign individuals, banks, corporations, or governments, are included in the demand deposit component of the money stock.

In the illustration, a Chicago bank will borrow Eurodollars for one day from a German bank, using the services of an Edge Act corporation, and then repay the amount through the Edge Act corporation (hereafter abbreviated to Edge Act). The Edge Act is located in New York City, but performs services for banks elsewhere in the United States as well as for European banks.

For the illustration, it will be necessary to report the transactions of two New York banks. One New York bank is the "correspondent" of the German bank which is lending funds to the Chicago bank. The other New York bank is used by the Edge Act to clear funds, that is, to receive transfers from the account of foreign lending banks and to repay borrowed funds to the account of foreign banks. In other words, the Edge Act maintains a checking (demand deposit) account at the New York (clearing) bank for purposes of conducting international transactions as a service to U.S. and foreign banks.

The effects on the money stock when a U.S. bank borrows Eurodollars for one day using an Edge Act corporation will be illustrated by T-account entries for three successive days.

First Day

A Chicago bank desires to borrow funds for a day, say $1000, from a European bank (possibly a branch of a U.S. bank in Europe), and instructs its foreign branch bank (say in London or Paris) to borrow Eurodollars and have the funds paid to the Edge Act which will transfer the amount to Chicago. The foreign branch of the Chicago bank arranges the loan from a German bank, which notifies its New York correspondent bank to draw a check on its account payable to the Edge Act. The initial transaction for the first day is by the New York correspondent of the German bank, which issues an Officers Check[1] payable to the Edge Act (and is delivered immediately to the Edge Act). This New York bank increases Officers Checks Outstanding and decreases the demand deposit account of the German bank, denoted as the Deposit of Foreigner account.

New York Correspondent of German Bank		
	Deposit of Foreigner − $1000 Officers Checks Outstanding + $1000 (payable to Edge Act)	No Net Effect on Demand Deposits

The Edge Act immediately takes the Officers Check to its clearing bank in New York and deposits the check to its own account. On its own books the Edge Act increases an asset account, Due from Bank (the New York correspondent) waiting for the check to clear, and also increases a liability account, Due to Bank (the Chicago bank).

[1]A change in the Federal Reserve Regulation D, effective July 31, 1969, requires that issuing banks include such items as "Officers Checks," used in the borrowing and repayment of Eurodollars, in gross demand deposits.

Edge Act Corporation		
Due from Bank + $1000 (from N.Y. correspondent of lender)	Due to Bank + $1000 (to borrower in Chicago)	No Net Effect on Demand Deposits

At the same time the Edge Act's clearing bank increases an asset account, Cash Items in Process of Collection, and increases a liability, Due to Bank (Edge Act).

New York Clearing Bank of Edge Act Corporation		
Cash Items in Process of Collection + $1000	Due to Bank + $1000 (to Edge Act)	**Demand Deposits Decrease**

In the meantime, the Edge Act notifies the Chicago bank that it has borrowed $1000 for one day from the German bank, and that collection of the funds is in progress, so the Chicago bank records an asset entry, Due from Bank (the Edge Act), and increases a nondeposit liability, Due to Foreign Branch.

Chicago Bank		
Due from Bank + $1000 (from Edge Act)	Due to Foreign Branch + $1000 (own overseas branch)	No Net Effect on Demand Deposits

At the close of business on the first day the entries recorded in the above T-Accounts show that the money supply has decreased by $1000. To see this, note that there is no effect on the net deposits of the New York correspondent of the German bank, since both Officers Checks and Deposits of Foreigners are included in the demand deposit component of money. Also, the deposits of the Chicago bank are not affected, since the liability account, Due to Foreign Branch, is not a deposit account and therefore does not enter into the computation of the money supply series, and the asset account, Due from Bank, does not affect the deposit component of money.[2] Furthermore, prior to the November 1970 revision of the money supply data, the transactions of Edge Act corporations were not considered in computing private demand deposits.

Finally, the clearing bank of the Edge Act has two entries that affect deposits. An increase in the liability account, Due to Bank, causes gross demand deposits to rise but, since these "interbank deposits" are subtracted from gross deposits to derive the demand deposit component of money, there is no net increase in demand deposits *from this entry.* Furthermore, the increase in the asset account, Cash Items in Process of Collection, causes a reduction of demand deposits of $1000, since "Cash Items" are also deducted from gross deposits to obtain the money component. The decrease in deposits occurs because there was no offsetting rise in net deposits. Stated simply, since the increases in both the asset and the liability accounts of the clearing bank are deducted from gross deposits, and since no other bank closed on the first day with a net increase in demand deposits, the demand deposit component of money has fallen $1000.

Second Day

On the second day the Officers Check will clear, reserves will be transferred first from the New York correspondent bank to the clearing bank, and then to the Chicago bank. Meanwhile, the Chicago bank will initiate repayment of the loan through the Edge Act. At the end of the second day the demand deposits will still be reduced by $1000. The day's transactions are shown in steps.

First, when the Officers Check clears, the New York correspondent loses reserves of $1000 and reduces its liability account, Officers Checks Outstanding.

New York Correspondent of German Bank		
Reserves − $1000	Officers Checks Outstanding − $1000	Demand Deposits Decrease

At the same time, the clearing bank gains the reserves and reduces its Cash Items in Process of Collection by $1000.

New York Clearing Bank of Edge Act Corporation		
Reserves + $1000 Cash Items in Process of Collection − $1000		Demand Deposits Increase

Upon receiving the reserves, the clearing bank initiates a transfer of funds to the Chicago bank, so the former bank loses the reserves it just received and reduces a liability, Due to Bank.

New York Clearing Bank of Edge Act Corporation		
Reserves − $1000	Due to Bank − $1000 (due to Edge Act)	No Net Effect on Demand Deposits

As this transfer occurs, the Chicago bank reduces an asset, Due from Bank, to match the increase in reserves, and the Edge Act clears the transaction from its books.

Chicago Bank		
Reserves + $1000 Due from Bank − $1000		No Net Effect on Demand Deposits

[2]Liabilities due to its own foreign branches are not considered deposits by the parent bank. The parent is not required to hold reserve balances against these liabilities (as they are against "due to domestic commercial banks"), and these deposits are not considered to be a part of the "private demand deposits in the hands of the public."

Edge Act Corporation		
Due from Bank −$1000	Due to Bank −$1000	No Net Effect on Demand Deposits

To initiate repayment of the borrowing of the previous day, the Chicago bank tells the Edge Act to make a deposit to the account of the German bank (at the latter's New York correspondent bank). As a provision for this repayment, the Chicago bank increases one liability account, Due to Bank (to the Edge Act), and decreases another liability, Due to Foreign Branch.

Chicago Bank		
	Due to Bank +$1000 (due to Edge Act) Due to Foreign Branch −$1000	No Net Effect on Demand Deposits

The Edge Act writes an Officers Check drawn on its account at its clearing bank and increases an asset, Due from Bank (Chicago).

Edge Act Corporation		
Due from Bank (Chicago) +$1000	Officers Checks Outstanding +$1000 (payable to German bank)	No Net Effect on Demand Deposits

The check is delivered to the New York correspondent which increases the German bank's account (Deposit of Foreigner) and increases its Cash Item in Process of Collection account.

New York Correspondent of German Bank		
Cash Items in Process of Collection +$1000	Deposit of Foreigner +$1000 (German bank)	No Net Effect on Demand Deposits

At the end of the second day, the New York correspondent has had an offsetting increase and decrease in deposits, with an increase in cash items, resulting in a decrease in the demand deposit component of money. The clearing bank of the Edge Act reduced its cash items, which caused the deposit component of money to rise at that bank, since there was no corresponding decrease in deposits (again, a change in the Due to Bank liability does not, by itself, result in a change in the deposit component of money). The entries of the Chicago bank are a reduction in the nondeposit account, Due to Foreign Branch, which has no effect at all, and an increase in the Due to Bank liability account, which increases this bank's gross demand deposits, then, it is subtracted out once again to compute the deposit component of money, resulting in no net effect. Again, the Edge Act entries did not enter into the computation of money.

On balance the above transactions for the second day do not result in a change in the demand deposit component of money *compared to the first day*. Since demand deposits were reduced at the end of Day 1, they remain at the lower level at the end of Day 2.[3]

Third Day

As repayment of the Day 1 loan is cleared on the third day, the money stock will be restored to its original $1000 greater level, assuming no new transactions through Edge Act corporations have occurred in the meantime. To cover the Officers Check written by the Edge Act, the Chicago bank makes a transfer of funds to the account of the clearing bank of the Edge Act. The Chicago bank loses reserves and reduces its Due to Bank (Edge Act) liability account. The Edge Act reverses its prior entries to clear the transaction from its books, and the clearing bank of the Edge Act gains reserves and increases a liability account, Due to Bank (to New York correspondent of German bank).

Chicago Bank		
Reserves −$1000	Due to Bank −$1000 (Edge Act)	No Net Effect on Demand Deposits

Edge Act Corporation		
Due from Bank −$1000	Officers Checks Outstanding −$1000	No Net Effect on Demand Deposits

New York Clearing Bank of Edge Act Corporation		
Reserves +$1000	Due to Bank +$1000 (New York correspondent)	No Net Effect on Demand Deposits

Upon receiving the reserves from the Chicago bank, the clearing bank makes a transfer of funds to the New York correspondent. The entries for the clearing bank are a decrease in reserves and a reduction of the account, Due to Bank. The entries for the New York correspondent of the German bank are an increase in reserves and a reduction of Cash Items in Process of Collection.

New York Clearing Bank of Edge Act Corporation		
Reserves −$1000	Due to Bank −$1000 (New York correspondent)	No Net Effect on Demand Deposits

[3]The reader may note that if the Chicago bank had borrowed another $1,000 on the second day all of the entries for the first day would be repeated in addition to the above entries for Day 2, and the deposit component of money would be understated an additional $1,000. This point will be discussed again at the end of this Appendix.

New York Correspondent of German Bank	
Reserves +$1000 Cash Items in Process of Collection −$1000	Demand Deposits Increase

It should be clear that the deposit component of money rises at the New York correspondent bank, since the asset it deducts from gross demand deposits, Cash Items in Process of Collection, is reduced while there is no corresponding decrease in deposits. The entries for the Edge Act and the other banks have no effect. The demand deposit component of money is returned to the level at the beginning of the first day.

Possibility of "Double Underestimation"

As indicated in footnote three of this Appendix, the example transactions involving an Edge Act corporation, which illustrate how an understatement of private demand deposits can occur, could result in deposits being understated by twice the amount of the Euro-dollar borrowings of the example (Chicago) bank, if the bank were to borrow the same amount every day, for one day. In the illustration used, the original amount borrowed from the example German bank was already included in the private demand deposit component of money. If the original $1000 had been, for instance, a deposit at a foreign branch of the New York correspondent bank, and the amount was transferred from the branch to its New York parent when the loan was made, then the deposit component of money would not have been reduced on the first day. The fall in deposits at the clearing bank would have been matched by a temporary rise in deposits at the New York correspondent. The demand deposit component of money would then fall on the second day, as the amount is both cleared to Chicago and repayment is initiated through the Edge Act.

Similarly, if the original amount held by the German bank had been a time deposit at its New York correspondent bank, the demand deposit component of money would not have been reduced until the second day.

Expectations, Money, and the Stock Market*

by MICHAEL W. KERAN

In recent years, increasing attention has been given to analyzing influences of expectations and monetary actions on the course of economic activity. This article examines the response of the general level of stock market prices (measured by the quarterly average of the Standard and Poor's 500 Daily Index) to these two influences. Attention is given exclusively to explaining the general movement of stock prices rather than to explaining very short-run movements in the level of stock prices or changes in the prices of individual stocks.

The standard theory of stock price determination — discounting to the present the value of expected future earnings — is used to extend the St. Louis model to include relationships which influence the level of stock prices. The discounting procedure involves the use of an interest rate to determine the present value of expected corporate earnings over some future time horizon.

The statistical estimates of the stock market relationships lead to the conclusion that the general level of stock prices is influenced mainly by expected corporate earnings and expectations of inflation. An increase in expected corporate earnings leads to a higher level of stock prices. Expectations of increasing inflation were found to lower the level of stock prices and not to raise it as is commonly argued. Inflationary expectations increase both expected corporate earnings and the interest rate at which these earnings are discounted. Evidence is presented in this study, however, that changes in inflation expectations exert a much greater influence on the rate of discount than on expected corporate earnings. This explains the negative relationship found between the general level of stock prices and expectations of inflation.

Expectations are formed on the basis of current and past events. Corporate earnings expectations, according to this study, are formed on the basis of actual earnings over the preceding five years. Inflation expectations are formed on the basis of actual rates of inflation over the past four years. Since these formation periods are quite long, fundamental changes in expectations occur slowly.

According to the St. Louis model (this Review, *April 1970), monetary actions, measured by changes in the money stock, exercise an important influence on gross national product, the price level, and real output. Since movements in these three economic magnitudes are basic factors in the formation of expectations in the stock market, the expanded model developed in this article is used to examine the response of the general level of stock prices to changes in the rate of monetary expansion. The major influence of changes in money on the level of stock prices was found to be indirect — operating through induced changes in expectations.*

THE STOCK MARKET is perhaps the most talked about and the least understood of all major economic phenomena. The primary reason for this is the major influence which expectations play in determining stock market prices. The lack of knowledge about how expectations are formed and how they operate on the stock market has been the major impediment to empirical research in this area.

In a pioneering work in 1964, Beryl Sprinkle handled this problem by essentially leapfrogging the expectations issue and analyzing the relationship directly between changes in the money stock and movements in the aggregate stock price index.[1] Sprinkle observed that at least since World War I the stock price index has moved systematically with changes in the money stock. He explained this phenomenon as an element in the quantity theory of money.

In a recent article, Malkiel and Cragg have explicitly introduced expectations into the determination of stock prices of individual corporations.[2] They surveyed a cross section of security analysts with respect to their forecasts for corporate earnings and compared these forecasts with the actual stock price at the time of the forecast. They concluded that earnings expectations were an important influence on the stock price of a corporation. Clearly, investors put their money where their expectations are.

It is the intention of this article to integrate the money supply and expectations approaches to determination of the aggregate stock price index. In the first part of the article, a very simple stock market model is developed which incorporates a method of measuring corporate earnings expectations. The empirical estimation of this model indicates that the earnings expectations variable and the long-term interest rate are the dominant factors in stock price formation. Next, the article considers the factors which determine interest rates and corporate earnings. Using the factors which were found to determine interest rates (which includes changes in money), the stock price equation is re-estimated in a "semi-reduced form" specification. Using this alternative stock price equation and the "St. Louis" econometric model, a number of dynamic *ex post* and *ex ante* simulation experiments are performed. The results of these experiments conform closely to the actual stock price movement in most time periods tested.

The Stock Market Model

The Theory — The theory of stock price determination has always been clear in concept but weak in application. Conceptually, the price an individual is willing to pay for an equity share is equal to the discount to present value of both expected future dividends and the discount to present value of the expected stock price at the time of sale. In its simplest form, this relationship can be represented by the following equation:[3]

$$(1)\ SP_t = \frac{D^e_{t+1}}{(1+R)} + \frac{D^e_{t+2}}{(1+R)^2} + \ldots + \frac{D^e_{t+n}}{(1+R)^n} + \left[\frac{SP^e_{t+n}}{(1+R)^n}\right]$$

where:

SP_t = Stock Price today — as valued by the individual investor.

SP^e_{t+n} = Stock Price expected at time of sale

D^e = Dividends expected

R = Interest Rate expressed in decimal form (8.1% is written as .081)

The value which an individual will place on equities today will rise if dividends are expected to rise or if the stock price is expected to be higher at the date of sale (so-called capital gains). The value an individual attaches to equities today will fall if the interest rate increases, because the rate at which one discounts expected future dividends and capital gains has risen, and consequently the present value is lower.[4]

---

*This article has benefited substantially from comments on earlier drafts by Lewis Drake, Otto Eckstein, Harry Johnson, Thomas Mayer, David Meiselman, Robert Rasche, Fred Renwick, and William White. In addition, the author owes a special thanks to his colleagues, Leonall Andersen, Christopher Babb and Jerry Jordan. Any errors in the analysis are, of course, the responsibility of the author.

[1]See Beryl Sprinkle, *Money and Stock Price* (Homewood, Illinois, Richard D. Irwin Co., 1964). James Meigs investigates the Money-Stock Price issue with more sophisticated statistical methods in his manuscript in preparation.

[2]Burton Malkiel and John Cragg, "Expectations and the Structure of Share Prices," *American Economic Review*, September 1970. This article also includes an extensive and up-to-date bibliography on the stock market.

[3]This formulization asserts that each investor has an explicit time horizon which is equivalent to the date he expects to sell his stock. It is not necessary that the investor actually sell the stock in period t+n. It is possible that his expectations about the future stock price and dividends are not realized, which would cause the actual sale date to change.

A simplifying assumption is that the attitudes about risk are unchanged, or are accurately incorporated into the interest rate. In addition, some individual's opportunity cost may not be adequately measured by market interest rates. The interested reader is referred to Eugene M. Lerner and Willard T. Carleton, *A Theory of Financial Analysis* (New York: Harcourt, Brace & World, 1966), especially chapters 7-9, and Fred B. Renwick, *Introduction to Investment and Finance; Theory and Analysis*, (New York: McMillan, January 1971) for a more complete and formal analysis of stock price determination.

[4]There are a number of important factors which are common in their effects on the interest rate and the stock price. Thus, any statistical analysis (such as presented in this article)

An economic decision-making unit will wish to invest its portfolio in such a way as to maximize the discounted value of returns from alternative investments. This implies that the last dollar invested in the equity market should give the same expected rate of return as the last dollar invested in alternative markets. If the price of bonds falls because of a shift in the supply schedule, interest rates have risen, and some investors will find it to their advantage to switch out of the stock market and into the bond or other markets. Other things equal, this switching will have a depressing effect on stock prices.

Aggregation Issues — When one moves from a description of individual investor behavior to a description of aggregate or average investor behavior, the formulation of the discount to present value theory is somewhat modified.[5] In the case of the individual investor, the price of the stock is given and the investor will either buy or sell, depending upon whether his individual evaluation of expected return (discounted to present value) is greater or less than the market price of the stock. In the case of aggregate investor behavior, it is the current quantity of equities outstanding which is relatively fixed in the short run and the stock price which must move to clear the market. Therefore, the average investor evaluation of expected returns (discounted to present value) will determine the price of the stock.

For the individual investor it is reasonable to assume that investment decisions are made on the basis of an explicit or implicit time horizon, t+n. For average investor behavior, one must assume something approaching an infinite time horizon, because the longest time horizon of the individual investor will dominate the time horizon of the average investor, (where the average investor is merely the weighted sum of the individual investors).[6] Thus, we can re-write the average investor equation with respect to the stock price as:

$$(2)\quad SP_t = \frac{(D^e+\Delta SP^e)_{t+1}}{(1+R)} + \frac{(D^e+\Delta SP^e)_{t+2}}{(1+R)^2}\ldots$$

where:

ΔSP^e = expected change in the stock price in each time period;

$\Delta SP^e_{t+1} = SP^e_{t+1} - SP_t$

$\Delta SP^e_{t+2} = SP^e_{t+2} - SP^e_{t+1}$

etc.

A shift in emphasis also occurs when one moves from determination of the stock price for one firm to determination of the average stock price of all firms. The primary factor in investor expectations of increases in the stock price, ($\Delta SP^e > 0$) in the case of the single firm, is the relative competence of management in productively employing new capital. This is irrespective of whether the new capital is financed by retained earnings or by debt issues. In the case of the average stock price of all firms, however, the differential management factor tends to remain constant. In this case it is not unreasonable to postulate that the major factor in expected capital gains is the rate at which retained earnings are plowed back into the firm.[7] If (k) is defined as the ratio of dividends to earnings (the expected payout ratio), then $(1-k)$ is the expected retained earnings ratio, and the ag-

which is designed to explain the stock price with interest rates as one of the important arguments, must consider the simultaneous interaction among certain variables. For example, inflation expectations can lead to both higher earnings expectations and to higher interest rates. Or, an increase in the real growth rate can also lead to both higher interest rates and higher earnings expectations.

In the former case, the problem can be handled by distinguishing between real and nominal interest rates and expected earnings. This is done later in the article, especially in equation (16). In the latter case, no explicit separation can be made. However, given the way in which real earnings expectations are developed in this article, it is implicitly accounted for.

There are, of course, other ways of separating the common elements in the interest rate and the stock price than those employed here. The test, however, of the appropriateness of any procedure is its degree of success in explaining the past and forecasting the future movement in the stock price.

[5]The determination of stock prices on the basis of discounting expected future returns would be generally accepted by most economists. However, there is considerable professional controversy with respect to the proper interpretation of this theory. To a large extent, the debate is over the factors which affect behavior of the individual investor or individual firm share price. This article is concerned with the factors which affect aggregate investor behavior and the average stock price of all firms. While there is obviously a substantial overlap, there are a number of factors that are important in the individual case but tend to average out in the aggregate, such as the quality of management, the ratio of debt to equity, and the time horizon of the individual investor. As long as these basic factors are unchanged on average, they would not be expected to cause changes in the aggregate stock price index.

[6]There are a whole range of interest rates representing maturities at different points in time. Discounting the present value of the expected flow one time period in the future should be at the interest rate for instruments which mature one time period in the future. Discounting the expected flow "n" time periods in the future should be at the interest rate for bonds which mature in the n^{th} time period. Discounting with one "representative" interest rate introduces a potential bias into the stock price estimate, because the term structure of interest rates is not flat. However, the least bias will occur if a long rate is used. According to Meiselman, the long rate is the weighted average of expected short-term rates. For example, the current rate on a 10-year bond is a function of the current rate on a 1-year bond and the expected rate on one-year bonds in the second through tenth years. See David Meiselman, *The Term Structure of Interest Rates* (Chicago: University of Chicago Press, 1963).

[7]The return on investment financed with debt instruments can, as a first approximation, be considered as equal to the average interest rate paid on these instruments when all firms are aggregated. This assumption allows us to ignore the source of financing new capital equipment.

gregate stock price, equation (2) can be re-written as follows:

$$(3)\ SP_t = \frac{[kE^e + (1-k)E^e]_{t+1}}{(1+R)} + \frac{[kE^e + (1-k)E^e]_{t+2}}{(1+R)^2} \cdots$$

which simplifies to

$$= \frac{E^e_{t+1}}{(1+R)} + \frac{E^e_{t+2}}{(1+R)^2} \cdots$$

or

$$= \frac{\sum_{i=1}^{\infty} E^e_{t+i}}{(1+R)^i}$$

where E^e stands for expected future corporate earnings.[8] This formulation allows us to omit explicit consideration of expected capital gains. Expected earnings will be used either to pay expected dividends (k) or to add to expected capital growth (1–k).[9]

Estimation Issues – One of the major problems in applying the stock price theory described in equation (3) to an analysis of actual stock price movement is to determine how earnings expectations are formed. There are two approaches to analyzing expectations. If the future is expected to be roughly similar to the recent past, then the "adaptive expectations hypothesis" is used. This hypothesis asserts that in forming expectations about the future, decision-making units are strongly influenced by current and recent past experience. As time goes on and new facts become available, expectations are adapted to accommodate them.

If, however, the future is expected to be sharply different from the recent past, then expectations will be formed on the basis of some similar historic period rather than on the most recent past. For example, when the United States economy switched from war to peacetime conditions in early 1946, expectations were formed more on the basis of what happened before World War II than on what was occurring during World War II.[10]

In most "normal" periods it is reasonable to postulate that the adaptive expectations hypothesis is the most plausible description of expectations behavior. On this basis we will assert that expected corporate earnings, and through this the stock price, are significantly dependent upon the actual level of current and past corporate earnings. The Almon distributed lag approach is used to estimate expectations.

To put the stock price theory into a form which separates the earnings expectations hypothesis from the interest rate effect, it is specified as follows:[11]

[8]This formulation is in terms of nominal expected earnings. An alternative formulation would separate this into expectations of real earnings and expectations of inflation. This latter formulation would also require the interest rate to be separated into real and inflation expectation components. In this case, the stock price formulation would look as follows:

$$(3\text{-A})\ SP_t = \frac{\sum_{i=1}^{\infty} E^{*e}_{t+i} (1+\dot{P}^e)^i}{(1+R^*)^i\ (1+\dot{P}^e)^i}$$

where $\dot{P}^e$ represents inflation expectations, E^{*e} represents expected real earnings, and R^* is the real interest rate today. If inflation expectations are the same for earnings and interest rates, then the inflation effect on stock prices will be zero. That is, the numerator and denominator will rise by the same proportion, and the ratio (which determines the stock price) will be unchanged.

This would be the case in the long-run steady state solution when expected inflation ($\dot{P}^e$) equals actual inflation ($\dot{P}$) for a sufficiently long period that all decision-making units had completely adjusted. Short of this steady state solution, however, the "gap" between real and nominal values could be achieved in systematically different ways in earnings and interest rates. Then the stock price would not be invariant to inflation expectations. For example, if the gap between real and nominal earnings is achieved by a fall in real earnings and a constant level of nominal earnings, while the gap between real and nominal interest rates is realized by constant real interest rates and rising nominal rates, then the stock price will fall.

Another factor which could affect the stock price is a once-and-for-all increase in goods prices. This would not affect inflation expectations because the rise in prices is not expected to continue. Such an event would lead to an increase in nominal earnings and therefore to an increase in earnings expectations, but would not lead to an increase in the interest rate. In this circumstance, the stock price formulation in equation 3-A would tend to understate the actual stock price.

This conceptually possible event is not probable in the real world, short of a major war or natural disaster which would make any analysis of stock prices redundant. If the change in goods prices is in relatively small increments, and the increase in factor prices occurs with a lag (both plausible statements), then the practical bias in equation 3-A can be considered negligible.

For an interesting discussion of how to diminish the market distortions related to strong inflation expectations, see David Meiselman, "Institutional Reforms to Moderate the Effects of Variable Price Levels," *Journal of Economic Issues,* June/September 1970, pp. 77-86.

[9]The individual tax rate on expected dividends (kE^e) will be higher than on expected capital gains ($1-kE^e$) in the United States. Thus, even if expected earnings are unchanged, a decrease in the dividend rate (k) would shift earnings into a form in which the tax rate is lower, which would tend to raise the stock price. The formulation in equation (3) implies that the expectations about k at any one point in time (t) is stable for the time horizon of the typical investor. This implication is reasonable, given that k in the period 1947-70 has had no secular trend.

[10]See Thomas Sargent, "Some New Evidence on Anticipated Inflation and Asset Yields" (Unpublished Manuscript), National Bureau of Economic Research, August 1970.

[11]The equation was also estimated in a nonlinear additive form, and the results were virtually the same, except that the R^2 and S.E. were somewhat better in the linear form used in the text.

$$(4)\ SP_t = a_0 + \sum_{i=0}^{1} a_1 R_{t-i} + a_2 E^e_t$$

$$(5)\ E^e_t = \left[\sum_{i=0}^{n} w_i\right] E_{t-i}$$

Equation (4) states that the stock price in the current time period (SP_t) is a function of interest rates in the current and one lagged time period, and current expectations about future corporate earnings (E^e). The one-quarter lag in (R) is designed to capture the possible lag in investor awareness of, and response to, changes in rates. We postulate that the value a_1 is negatively related to the stock price, and that the value a_2 is positively related to the stock price.

Equation (5) states that expectations of future corporate earnings after taxes are a weighted sum (Σ) of current and past corporate earnings after taxes. The value w_i represents the weights applied in forming earnings expectations at various periods in the past, and "n" indicates how many periods in the past are relevant in forming earnings expectations.

Substituting equation (5) into equation (4) yields a form of the equation which can be estimated empirically:[12]

$$(6)\ SP_t = a_0 + \left[\sum_{i=0}^{1} a_1\right] R_{t-i} + \left[\sum_{i=0}^{n} a_2 w_i\right] E_{t-i}$$

The stock price equation was estimated with quarterly data for time periods as short as 1960-70 to as long as 1952-70. The longest time period which gave statistically significant results was 1956-70.[13] That result is presented in equation (7).

STOCK PRICE EQUATION

Sample Period: I/1956 - II/1970

(Summary Results)

$$(7)\ SP_t = \underset{(3.08)}{12.33} - \sum_{i=0}^{1} \underset{(4.48)}{16.27}\, R_{t-i} + \sum_{i=0}^{19} \underset{(8.69)}{4.44}\, E_{t-i} \qquad R^2 = .94 \quad S.E. = 4.70 \quad D\text{-}W = .74$$

(Detailed Results)

R_0 =	−19.30 (4.04)
R_1 =	3.03 (.60)
ΣR_i =	−16.27 (4.48)

E_0 =	1.65 (7.42)	E_{11} =	.14 (2.15)
E_1 =	.32 (3.67)	E_{12} =	.05 (.91)
E_2 =	−.30 (2.48)	E_{13} =	.01 (.21)
E_3 =	−.46 (5.10)	E_{14} =	.05 (.73)
E_4 =	−.36 (5.92)	E_{15} =	.17 (2.25)
E_5 =	−.15 (2.35)	E_{16} =	.36 (4.54)
E_6 =	.06 (.92)	E_{17} =	.57 (5.84)
E_7 =	.23 (3.90)	E_{18} =	.69 (5.24)
E_8* =	.31 (6.13)	E_{19} =	.58 (4.37)
E_9 =	.30 (5.31)	ΣE_i =	4.44 (8.69)
E_{10} =	.24 (3.58)		

Constraints: 6th Degree Polynomial for E
2nd Degree Polynomial for R
$E_{t+1} \neq 0;\ E_{t-n} = 0$
$R_{t+1} \neq 0;\ R_{t-n} = 0$

Note: "t" statistics appear with each regression coefficient, enclosed by parentheses. An estimated coefficient is considered statistically significant if its accompanying "t" statistic is 1.95 or larger. R^2 is the per cent of variation in the dependent variable which is explained by variations in the independent variables. S.E. is the standard error of the estimate. D-W is the Durbin-Watson statistic.

The stock price (SP) is measured by Standard and Poor's 500 Index.[14] The interest rate (R) is measured by the corporate Aaa bond yield on seasoned issues.[15] Earnings (E) are measured as corporate profits after taxes in billions of dollars from the national income accounts.

This specification explains 94 per cent of the variance in the level of the stock price index.[16] Both

[12]In this aggregate formulation of stock price determination, earnings expectations (E^e) do not take into account the degree of confidence or risk the average investor has with respect to how accurately his expectations will be realized. If this basic risk factor should change, then this adaptive expectation approach would not be sufficient to determine the stock price.

It would be desirable to include another variable in this equation to indicate the degree of confidence the average investor has about his earnings expectations. Experimentation with a number of proxies for investor confidence were tried, without success. Thus, the usefulness of this stock price formulation is dependent upon the absence of a major change in the average investor's confidence in his expectations of future earnings. By the same token, the length of time for which this equation explains the stock price indicates the period for which the confidence or risk factor of the average investor remained unchanged.

[13]The stock price equation with data from I/1952 to II/1970 predicts the stock price index as well as equation (7), when a dummy variable is added. The dummy variable assumes a value of 1 from I/1952 to II/1955, and zero thereafter. This result implies that the specified behavior was the same in both periods, but that some other factor (roughly measured by the dummy variable) was also important. This additional behavioral factor is most likely related to a change in attitude about risk. Stock price estimates could not be made prior to I/1952 because of data limitations. Specifically, earnings data (which has a 19-quarter lagged effect) were available quarterly since 1947.

[14]Standard and Poor's Stock Price Index is defined as follows:

$$\text{Index} = \frac{\Sigma Q_1 P_1}{\Sigma Q_0 P_0} \cdot (10)$$

where P_0 and Q_0 are the stock price and quantity in the base years 1941-43, P_1 is average price in the current period, and Q_1 is the volume of stock outstanding in the current period. The index is also adjusted for stock splits.

[15]A stock price equation with a roughly similar interest rate specification can be found in the MIT-FRB model. See Frank de Leeuw and Edward Gramlich, "The Federal Reserve MIT Econometric Model," Federal Reserve *Bulletin*, January 1968, pp. 11-40.

[16]All equations in this article are estimated by the Almon distribution lag technique. By constraining the distribution of coefficients to fit a polynomial curve of n degree, it is designed to avoid the bias in estimating distributed lag coefficients which may arise from multicollinearity in the lag values of the independent variables. The theoretical justification for this procedure is that the Almon constrained

the expected corporate earnings variable (E) and the interest rate variable (R) have the expected sign and are statistically significant. Expectations about future earnings are based on the actual level of reported earnings in the current and 19 lagged quarters. The earnings expectations coefficient has a high degree of statistical significance and explains a major share of the movement in stock prices from 1956 to 1970.[17]

One weakness of the stock price specification in equation (7) is the low Durbin-Watson (D-W) statistic. This implies that the estimated value of the stock price is systematically above or below the actual stock price. This problem will be dealt with later in the article.

The Stock Market and the Economy

If we wish to understand how the stock market fits into the larger economic picture, we must consider the factors which explain long-term interest rates (R) and corporate earnings (E).

Interest Rates[18] — An analysis of the price of bonds will not only be of value because it is an important argument in the stock price equation, but because it is important for its own sake. In perpetuity (like British consols), the price of bonds can be represented as the reciprocal of the interest rate,

$$(8)\ BP = \frac{1}{R}$$

where BP represents the current bond price and R the current rate of interest. The following analysis will be explicitly in terms of long-term interest rates. However, because of the direct transformation illustrated in equation (8), we can also interpret the results in terms of the effect on bond prices.

The explanation of interest rates can be illustrated with three equations:

$$(9)\ R_t = R^*_t + \dot{P}^e_t$$

$$(10)\ R^*_t = c_0 + c_1 \dot{M}^*_t + c_2 \left[\sum_{i=0}^{n} u_i \right] \dot{X}_{t-i}$$

$$(11)\ \dot{P}^e_t = \left[\sum_{i=0}^{n} z_i \right] \dot{P}_{t-i}$$

Equation (9) states that the observed market long-term interest rate (R_t) is equal to the real rate of interest (R^*_t) and the expected rate of change in prices ($\dot{P}^e_t$). Equation (10) says that the real rate of interest is a function of a short-run liquidity effect and a real growth component. The real growth component is measured as a weighted average rate of change in real GNP, ($\dot{X}$): u_i indicates the weights applied to past time periods, and "n" indicates how many time periods are relevant in determining the real growth rate. The coefficient c_2 indicates the effect of the real growth rate on the interest rate; c_2 is postulated to be positive.

The short-run liquidity effect is measured by the current rate of change in the real money stock ($\dot{M}^*_t$). The real money stock is defined as the nominal money stock (M) divided by the price index (P):

$$M^* = \frac{M}{P}$$

This liquidity effect results from current investment being temporarily financed from sources other than intended savings, which is possible as a consequence of the creation of new money. This should have a negative effect on the rate of interest, and is sometimes referred to as the "Wicksell effect."

Equation (11) says that the expected rate of change in prices ($\dot{P}^e_t$) is a function of past price changes, where z_i is the weight or importance attached to each past time period in the formation of price expectations, and "n" is the number of past time periods that are relevant in forming price expectations. Actual price changes are measured by the GNP implicit price deflator.[19]

estimate is superior to the unconstrained estimate, because it will create a distribution of coefficients which more closely approximates the distribution derived from a sample of infinite size. In order to minimize the severity of the Almon constraint, the maximum degree of the polynomial was used in each case. The maximum degree is equal to one more than the number of lags of the independent variables up to five lags. This follows the convention established by Shirley Almon, "The Distributed Lag Between Capital Appropriations and Expenditures," *Econometrica,* January 1965. The lag on earnings (E) was selected on the basis of minimum standard error (S.E.) of estimate.

[17]The coefficient 4.44 on the earnings expectations variable consists of two components; w_i, the weights applied to current and past actual earnings to generate expected earnings, and a_2, the effect on stock prices of a given level of expected earnings. There is no reason to assume that $\Sigma w_i = 1$. Therefore, we cannot separate ($a_2 \cdot w_i$) into its component parts. Fortunately for purposes of estimating the stock price index, such separation is not necessary. This observation also applies to equation (16), where other expectation variables are used.

[18]The discussion in this section relies heavily on the work of Yohe and Karnosky, "Interest Rates and Price Level Changes, 1952-69" this *Review* (December 1969), and Anderson and Carlson, "A Monetarist Model for Economic Stabilization" this *Review* (April 1970).

[19]The effect of price expectations on interest rates has had a long history in economic literature. As early as 1910, Irving Fisher published a study relating the impact of price expectations on interest rates. Because of his pioneering work in this area, such price expectation effects on interest rates are referred to as the "Fisher effect."

Substituting equations (10) and (11) into equation (9) yields the form of the equation which was estimated:

$$(12)\quad R_t = c_0 + c_1 \dot{M}^*_t + \left[\sum_{i=0}^{n} c_2 u_1\right]\dot{X}_{t-i} + \left[\sum_{i=0}^{n} v_1\right]\dot{P}_{t-i}$$

Equation (12) asserts that the interest rate in the bond market is influenced by three factors. Expectations of inflation ($\dot{P}$) is measured by the adaptive expectations approach, and should be positively related to interest rates. The real growth of the economy ($\dot{X}$) should be positively related to the interest rate. The liquidity effect ($\dot{M}^*$), on the other hand, is postulated to be negatively related to interest rates. To test the various elements of the hypothesis contained in equation (12), it was estimated using quarterly data from I/1955 to II/1970. R is measured by the Corporate Aaa bond rate on seasoned issues.

LONG-TERM INTEREST RATE EQUATION

Sample Period: I/1955 - II/1970

(Summary Results)

$$(13)\quad R_t = \underset{(4.63)}{1.22} - \underset{(3.55)}{.06}\,\dot{M}^*_t + \sum_{i=0}^{16} \underset{(2.11)}{.15}\,\dot{X}_{t-i} + \sum_{i=0}^{16} \underset{(20.31)}{1.00}\,\dot{P}_{t-i} + \underset{(12.56)}{1.60}\,Z_t$$

$R^2 = .94$
S.E. = .30
D-W = .74

(Detailed Results)

$\dot{X}_0$ = .02 (3.20)	$\dot{X}_6$ = .01 (1.87)	$\dot{X}_{12}$ = .00 (.79)
$\dot{X}_1$ = .02 (3.55)	$\dot{X}_7$ = .01 (1.57)	$\dot{X}_{13}$ = .00 (.70)
$\dot{X}_2$ = .02 (3.58)	$\dot{X}_8$ = .01 (1.34)	$\dot{X}_{14}$ = .00 (..63)
$\dot{X}_3$ = .01 (3.24)	$\dot{X}_9$ = .01 (1.15)	$\dot{X}_{15}$ = .00 (.57)
$\dot{X}_4$ = .01 (2.73)	$\dot{X}_{10}$ = .01 (1.01)	$\dot{X}_{16}$ = .00 (.52)
$\dot{X}_5$ = .01 (2.25)	$\dot{X}_{11}$ = .01 (.89)	$\Sigma\dot{X}_i$ = .15 (2.11)
$\dot{P}_0$ = .01 (.53)	$\dot{P}_6$ = .08 (17.81)	$\dot{P}_{12}$ = .07 (9.24)
$\dot{P}_1$ = .03 (2.20)	$\dot{P}_7$ = .08 (14.68)	$\dot{P}_{13}$ = .06 (8.85)
$\dot{P}_2$ = .04 (4.95)	$\dot{P}_8$ = .09 (12.66)	$\dot{P}_{14}$ = .05 (8.53)
$\dot{P}_3$ = .05 (9.85)	$\dot{P}_9$ = .08 (11.33)	$\dot{P}_{15}$ = .03 (8.28)
$\dot{P}_4$ = .07 (17.68)	$\dot{P}_{10}$ = .08 (10.41)	$\dot{P}_{16}$ = .02 (8.06)
$\dot{P}_5$ = .07 (21.17)	$\dot{P}_{11}$ = .08 (9.75)	$\Sigma\dot{P}_i$ = 1.00 (20.31)

Constraints: 2nd Degree Polynomial for $\dot{X}$, $\dot{P}$,

$\dot{X}_{t+1} \neq 0;\ \dot{X}_{t-n} = 0$

$\dot{P}_{t+1} \neq 0;\ \dot{P}_{t-n} = 0$

Note: "t" statistics appear with each regression coefficient, enclosed by parentheses. An estimated coefficient is considered statistically significant if its accompanying "t" statistic is 1.95 or larger. R^2 is the per cent of variation in the dependent variable which is explained by variations in the independent variables. S.E. is the standard error of the estimate. D-W is the Durbin-Watson statistic.

The equation as specified explains 94 per cent of the variance in long-term interest rates (R). All coefficients are statistically significant and have the theoretically expected sign. The estimated coefficients indicate that for every 1 per cent annual rate acceleration in the real money stock, interest rates will decrease by 6 basis points; for every 1 per cent acceleration in the real growth rate of the economy, the interest rate will increase 15 basis points; and for every 1 per cent acceleration in expected prices, interest rates will increase 100 basis points.[20]

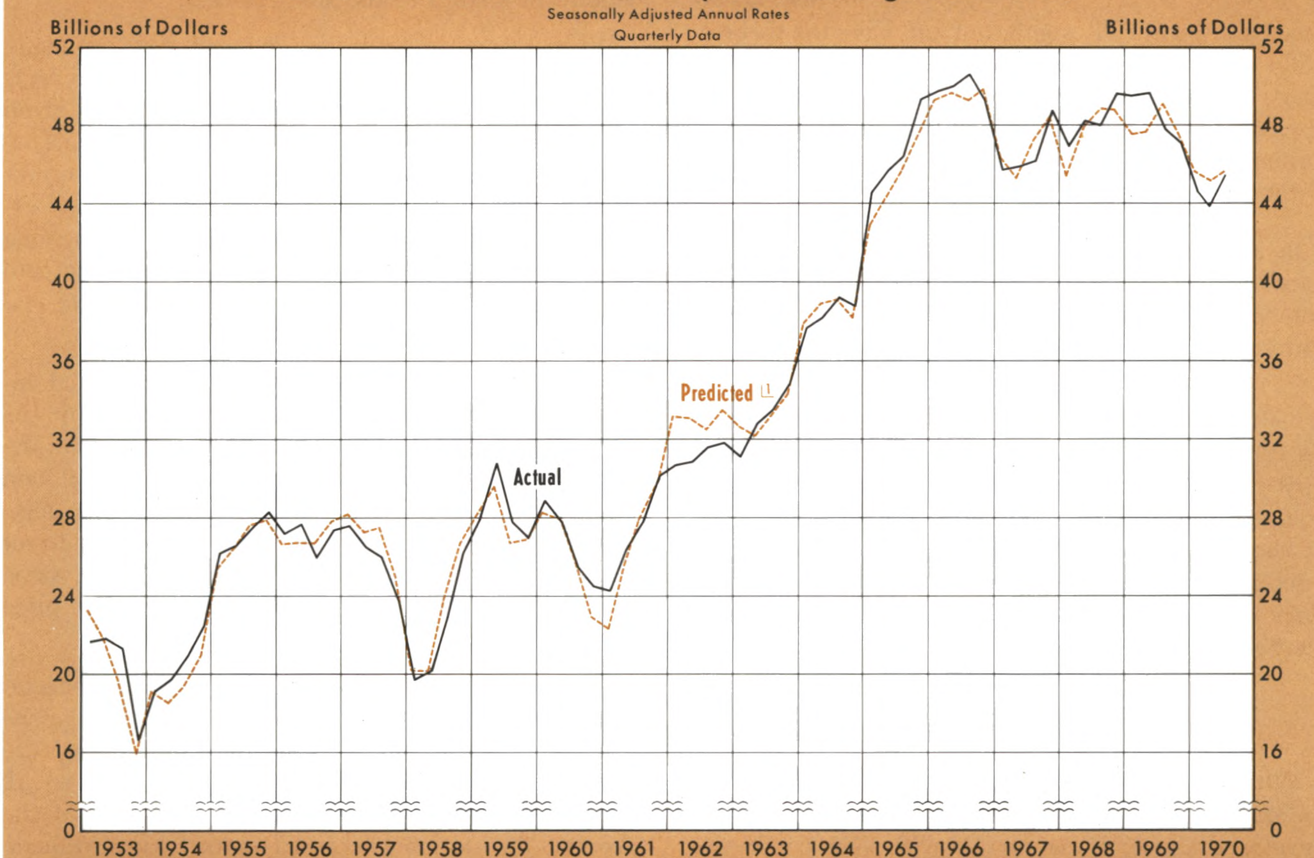
A dummy variable, Z_t, assumes the value of "0" from 1955 to 1960, and the value of "1" from 1961 to 1970. This variable is intended to partially account for an apparent shift in the financial market relationships which distinguished the 1950's from the 1960's.

Corporate Earnings – Corporate earnings can be thought of as the return to risk-taking capital. For any one corporation, the competence of the management, the costs of factor inputs, and the demand for the product are the key variables in explaining earnings. However, for the economy as a whole, the management factor tends to change only slowly, and the major dynamic factors are the strength of total demand and factor costs. Because total demand and costs move systematically with each other, and because the monetarist model, discussed below, does not have an explicit supply equation, we will only consider total demand factors.

In the short run, earnings are a residual after other costs of production have been accounted for, and therefore are sensitive to both changes in total demand and to the level of total demand. The most comprehensive measure of total demand is nominal GNP: it is the most important explanatory variable in our earnings equation. We will assert that the current level of total demand (Y_t), and changes in total demand in the current and past quarters $\left(\sum_{i=0}^{n} \Delta Y_{t-i}\right)$, have distinct and positive influences on earnings in the current period (E_t). If total demand is rising, but at a declining rate, then earnings may fall, as in the first half of 1970. This roughly captures cost-push effects on earnings.

[20]Following Andersen and Carlson, the current and lagged values of the price variable have been divided by the unemployment rate, on the assumption that price expectations are influenced not only by past movements in prices but by the relative slack of economic activity measured by the unemployment rate. In contrast to Andersen and Carlson, changes in real money rather than nominal money are used to measure the liquidity effect.

Actual & Predicted Values of Corporate Earnings After Taxes



[1] Predicted values are from equation 15 in the text. Predicted values in III/1970 are based on coefficients estimated through II/1970 and on actual values of the independent variables in III/1970.
Source: U.S. Department of Commerce

The other explanatory variable in the corporate earnings equation is the corporate tax rate (tx), which is mainly dependent upon Congressional legislation. A rise in the tax rate will lead to a fall in after-tax earnings, and vice versa.

The corporate after-tax earnings equation is specified in general terms as follows:

$$(14)\quad E_t = b_0 + b_1\, tx_t + b_2\, Y_t + b_3 \sum_{i=0}^{n} \Delta Y_{t-i}$$

where

- E = Corporate earnings after taxes (billions of dollars)
- tx = Corporate tax rate
- Y = Nominal GNP (billions of dollars)
- ΔY = Change in nominal GNP (billions of dollars)

We postulate that (b_1) is negative and that (b_2) and (b_3) are positive.

CORPORATE AFTER-TAX EARNINGS EQUATION
Sample Period: I/1953 - II/1970
(Summary Results)

$$(15)\quad E_t = \underset{(19.53)}{63.04} - \underset{(16.50)}{1.12}\, tx_t + \underset{(4.79)}{.013}\, Y_t + \sum_{i=0}^{12} \underset{(13.23)}{1.59}\, \Delta Y_{t-i}$$

$R^2 = .99$
S.E. = 1.11
D-W = .98

(Detailed Results)

ΔY_0 = .26	(13.35)	ΔY_7 = .10	(7.25)
ΔY_1 = .27	(15.95)	ΔY_8 = .07	(5.78)
ΔY_2 = .20	(12.93)	ΔY_9 = .04	(3.33)
ΔY_3 = .14	(9.38)	ΔY_{10} = .03	(2.59)
ΔY_4 = .12	(8.52)	ΔY_{11} = .05	(3.65)
ΔY_5 = .12	(8.10)	ΔY_{12} = .07	(3.87)
ΔY_6 = .12	(7.63)	$\Sigma \Delta Y_i$ = 1.59	(13.23)

Constraints: 6th Degree Polynomial
$\Delta Y_{t+1} = 0;\ \Delta Y_{t-n} = 0$

Note: "t" statistics appear with each regression coefficient, enclosed by parentheses. An estimated coefficient is considered statistically significant if its accompanying "t" statistic is 1.95 or larger. R^2 is the per cent of variation in the dependent variable which is explained by variations in the independent variables. S.E. is the standard error of the estimate. D-W is the Durbin-Watson statistic.

This equation explains 99 per cent of the variance in after-tax corporate earnings.[21] All of the coefficients are statistically significant and have the theoretically expected signs. As illustrated in the preceding chart, the estimated values of corporate earnings after taxes are very close to the actual values. Every cyclical turning point in corporate earnings, as well as most of the magnitude, is accounted for.

In a later section of this article we will be interested in real corporate earnings (E^*). Real corporate earnings can be defined as nominal corporate earnings (E) divided by the price index (P):

$$E^* = \frac{E}{P}.$$

To estimate real corporate earnings, it is only necessary to estimate nominal earnings as described in equation (15) and to divide this value by an estimate of the price index. (The method of estimating the price index is described later in the article when the stock market model is linked to the "St. Louis" econometric model.)

Direct Measures of Expectation Effects

What insights into the stock market can be acquired from the theoretical and empirical evidence developed above? It can be said with some confidence that the stock price is strongly influenced by expectations, and that these expectations are both rational and quantifiable. This should not be confused with the vague and random expectations typically associated with day-to-day movements in stock prices.

As estimated in equation (7), earnings expectations E^e play a key *direct* role in forming stock prices. Inflation expectations play an important *indirect* role in forming stock prices through their effect on interest rates. These expectations effects on stock prices, along with changes in real money and real growth (which are also important arguments in the interest rate equation), can be made explicit by going to a "semi-reduced form" equation which directly relates the rates of change in real money, real output, and price variables to stock prices. However, we would expect these variables ($\dot{M}^*$, $\dot{X}$, $\dot{P}$) to have signs with respect to the stock price (SP) that are the reverse of those with respect to interest rates (R). This is because the interest rate in equation (7) is negatively related to the stock price.

When we move to a semi-reduced form estimate, one issue which had been considered only in a footnote in the previous discussion must now be given explicit consideration. As mentioned in footnote (8), inflation expectations not only will affect the current level of interest rates but will also affect current expectations of future nominal earnings. In a sense, one can consider expectations of nominal earnings to consist of two components: an expectation of future real earnings, and an expectation of future inflation.

If inflation expectations raise current nominal interest rates and expected nominal earnings by the same proportion, then they will have no effect on the stock price. Put in a slightly different way, if inflation expectations, operating through nominal earnings, raise the stock price and, operating through current interest rates, lower the stock price by the same proportion, then the net impact on the stock price is zero.

It is not necessary, however, that inflation expectations should just offset each other with respect to the stock price except in the long-run equilibrium case when actual and expected inflation are equal. First, it is consistent with economic theory that the average investor in the bond market may evaluate inflation expectations differently than the average investor in the stock market, because of a different time horizon. This would imply that the gap between real and nominal interest rates and real and nominal expected earnings would be different. Second, even if expectations of the average investor in the stock market and the bond market were identical, it is possible that inflation may have a systematic effect on the spread between real interest rates and expected real earnings. This would be the case if inflation led to expectations of cost increases in excess of price increases, so that real earnings expectations would be lowered relative to real interest rates. With these considerations in mind, the reduced form stock price equation should be estimated with the following variables:

1) Changes in the real money stock ($\dot{M}^*$), because this is an argument in the interest rate equation;

2) Changes in real growth measured by changes in current and lagged real GNP ($\dot{X}$), because this is also an argument in the interest rate equation;

3) Changes in expected inflation measured by changes in current and lagged prices ($\dot{P}$).[22] This is

[21]Equation (15) is designed only as a method of estimating current earnings. This equation should not be considered an attempt to measure the *behavior* of the major decision-making units which affect corporate earnings. That objective would require a more sophisticated model than that presented here.

[22]For reasons discussed in footnote (15), P is divided by the unemployment rate.

both an argument in the interest rate equation and an element in the nominal earnings expectations variable. Thus, its net impact on the stock price could be plus, minus, or zero, for the reasons discussed above;

4) Expected real corporate earnings (E^{*e}) are measured as current and lagged values of real corporate earnings. We use real earnings expectations in this equation because that element of expected nominal earnings associated with inflation expectations should be captured by the inflation variable.

We would expect the coefficients associated with the rate of change in the real money stock ($\dot{M}^*$) and level of expected real earnings (E^*) to be positive, and the coefficient associated with real growth ($\dot{X}$) to be negative. The coefficient measuring expectations of inflation ($\dot{P}$) could be either positive or negative. The equation is estimated with quarterly data for the same time period as equation (7).[23]

Equation 16 explains 98 per cent of the variance in the level of the stock price index over the last fifteen years.[24] Each of the sum coefficients is statistically significant and has the expected sign. In this reduced form estimate of the stock price, all of the expectation variables are explicitly accounted for. Changes in real money ($\dot{M}^*$) and expected real earnings (E^*) have a positive effect on the stock price, while real growth ($\dot{X}$) has a negative effect on the stock price. Inflation expectations ($\dot{P}$) have a negative effect on the stock price.

This result is contrary to much popular thinking which asserts that inflation will help the stock price. The difference arises from the confusion between expected inflation and actual inflation. When inflation occurs, but is not expected to continue, there may be some increase in observed earnings of corporations, which would tend to raise earnings expectations and the stock price. However, when inflation is expected to continue, real earnings expectations are apparently not significantly influenced. This can be seen from comparing the sum coefficient for real corporate earnings expectations in equation (16) with the sum

ALTERNATIVE STOCK PRICE EQUATION
Sample Period: I/1956 - II/1970

(Summary Results)

$$(16)\quad SP_t = \underset{(9.84)}{-30.68} + \sum_{i=0}^{2} \underset{(4.14)}{1.31}\, \dot{M}^*_{t-i} - \sum_{i=0}^{7} \underset{(5.67)}{5.37}\, \dot{X}_{t-i} - \sum_{i=0}^{16} \underset{(7.93)}{11.96}\, \dot{P}_{t-i} + \sum_{i=0}^{19} \underset{(20.00)}{4.80}\, E^*_{t-i}$$

$R^2 = .98$; S.E. $= 2.49$; D-W $= 1.71$

(Detailed Results)

Variable	Coefficient	t
$\dot{P}_0$	−0.48	(1.84)
$\dot{P}_1$	−0.37	(1.73)
$\dot{P}_2$	−0.22	(1.39)
$\dot{P}_3$	−0.29	(1.29)
$\dot{P}_4$	−0.61	(2.18)
$\dot{P}_5$	−1.07	(3.75)
$\dot{P}_6$	−1.52	(5.58)
$\dot{P}_7$	−1.84	(6.80)
$\dot{P}_8$	−1.90	(7.06)
$\dot{P}_9$	−1.69	(6.62)
$\dot{P}_{10}$	−1.25	(5.38)
$\dot{P}_{11}$	−0.69	(3.11)
$\dot{P}_{12}$	−0.16	(0.69)
$\dot{P}_{13}$	0.18	(0.74)
$\dot{P}_{14}$	0.22	(0.87)
$\dot{P}_{15}$	−0.01	(0.02)
$\dot{P}_{16}$	−0.27	(0.98)
$\Sigma\dot{P}_i$	−11.96	(7.93)
$\dot{X}_0$	− .60	(4.13)
$\dot{X}_1$	− .89	(5.96)
$\dot{X}_2$	−1.05	(6.55)
$\dot{X}_3$	−1.08	(6.46)
$\dot{X}_4$	−0.93	(5.96)
$\dot{X}_5$	−0.61	(4.60)
$\dot{X}_6$	−0.23	(1.88)
$\dot{X}_7$	0.04	(0.29)
$\Sigma\dot{X}_i$	−5.37	(5.67)

Variable	Coefficient	t
E^*_0	1.17	(9.36)
E^*_1	1.16	(9.25)
E^*_2	0.64	(8.00)
E^*_3	0.05	(0.84)
E^*_4	−0.40	(5.53)
E^*_5	−0.60	(7.08)
E^*_6	−0.56	(6.99)
E^*_7	−0.34	(5.24)
E^*_8	−0.04	(0.79)
E^*_9	0.25	(4.72)
E^*_{10}	0.48	(8.19)
E^*_{11}	0.58	(9.73)
E^*_{12}	0.56	(9.46)
E^*_{13}	0.44	(7.26)
E^*_{14}	0.29	(4.43)
E^*_{15}	0.16	(2.46)
E^*_{16}	0.11	(2.04)
E^*_{17}	0.18	(3.28)
E^*_{18}	0.31	(4.28)
E^*_{19}	0.36	(4.74)
ΣE^*_i	4.80	(20.00)
$\dot{M}^*_0$	0.57	(3.62)
$\dot{M}^*_1$	0.52	(4.14)
$\dot{M}^*_2$	0.21	(1.30)
$\Sigma\dot{M}^*_i$	1.31	(4.14)

Constraints: 6th Degree Polynomial for E^*, $\dot{P}$, $\dot{X}$

3rd Degree Polynomial for $\dot{M}^*$

$\dot{X}_{t+1} = 0;\quad \dot{X}_{t-n} = 0$

$\dot{P}_{t+1} = 0;\quad \dot{P}_{t-n} = 0$

$E^*_{t+1} = 0;\quad E^*_{t-n} = 0$

$\dot{M}^*_{t+1} = 0;\quad \dot{M}^*_{t-n} = 0$

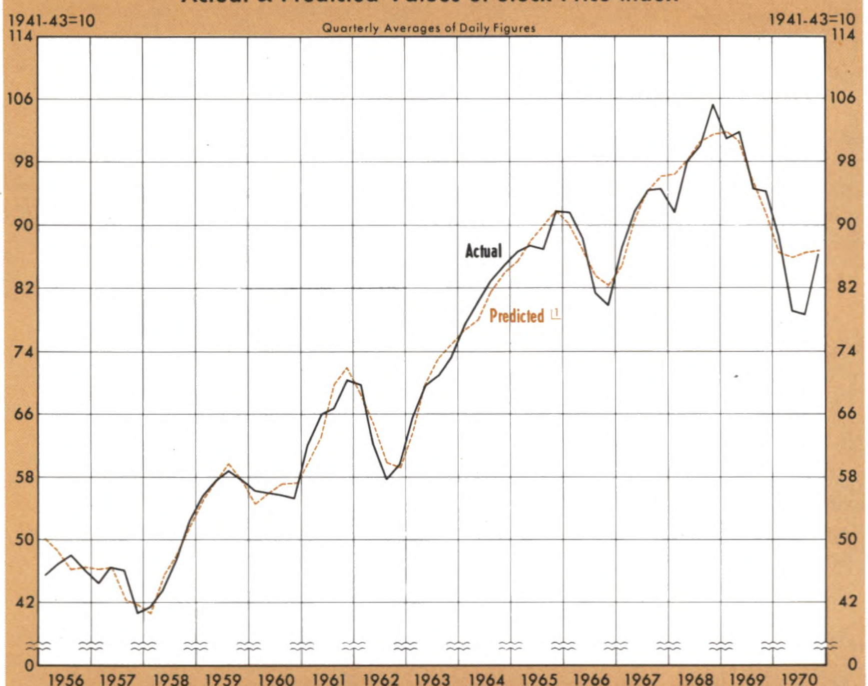
Note: "t" statistics appear with each regression coefficient, enclosed by parentheses. An estimated coefficient is considered statistically significant if its accompanying "t" statistic is 1.95 or larger. R^2 is the per cent of variation in the dependent variable which is explained by variations in the independent variables. S.E. is the standard error of the estimate. D-W is the Durbin-Watson statistic.

---

[23]The lags in equation (16) are not exactly those derived from equation (7) and (13). The major difference is with respect to $\dot{X}$. The longer lags on $\dot{X}$ in equation (13) had small and statistically insignificant coefficients and have been eliminated from equation (16).

[24]The R^2, SE, and D-W of equation (16) should be viewed in the light of comparable values when the stock price is regressed only with respect to a time trend. In this case $R^2 = .87$, SE $= 6.77$ and D-W $= .30$.

Actual & Predicted Values of Stock Price Index*



*Standard & Poor's Index 500 Stocks, 1941-43=10

[1] Predicted values are from equation 16 in the text. The predicted values for III/1970 and IV/1970 are based on coefficients estimated through II/1970 and on actual values of the independent variables in III/1970 and their estimated values in IV/1970.

Source: Standard & Poor's Security Price Index Record, 1970 Edition; Standard & Poor's Current Statistics, monthly.

coefficient for nominal corporate earnings expectations in equation (7). These values are not significantly different in a statistical sense. But, as indicated in equation (13), inflation expectations increase the interest rate which tends to depress the stock price. Thus, it is possible in the early stages of an inflation, when expectations have not become strong, for the stock price to rise. But when inflation continues long enough that the major decision-making units in the economy expect further inflation, the stock price will fall.

It is interesting to note the role of money in this reduced form stock price equation. A 1 per cent acceleration in real money will lead to a 1.31 point increase in the stock price index. This indicates a significant, but relatively small, direct influence on stock prices. If growth in real money moved from a zero to 5 per cent annual rate, the stock price index would increase by about 7 points over several quarters and have no further direct effect.

The relatively modest direct role of money can be seen by comparing it with real earnings expectations, which has an eight times larger impact on the stock price, and with inflation expectations, which has a 4½ times greater impact than money.[25]

There are, however, important indirect influences of money on stock prices which clearly exceed the direct influence. Money, as will be described in the next section, has an important influence on real output, prices, and earnings. Through this process, changes in money are the dominant factor, both direct and indirect, influencing stock prices.

The actual stock price, and values predicted by equation (16), are shown in the adjacent chart. This shows how closely equation (16) has been able to track major movements in the stock price from I/1956 through IV/1970.

The largest "miss" in the chart occurred in II/1970 and III/1970, when the estimated stock price was 7 and 8 points above the actual stock price index. The actual and estimated stock prices in IV/1970 returned to their normal close relation.[26] This event implies that an important but basically random shock pushed the stock price down temporarily in II/1970, which was not reversed until IV/1970.

The inability of the stock price equation to capture the major decline in II/1970 should caution the reader about applying this model to forecasting. No matter how well the model has explained past stock price movements, the emergence of essentially noneconomic events, such as the Cambodian incursion and the campus riots of May 1970, may at least temporarily affect stock prices.[27] The major utility of the model lies in its use in systematically analyzing the basic factors which history has shown to determine the long-term trend in stock prices.

Experiments with the Stock Market Model

If the stock market model described above is integrated into a larger econometric model of the United States, it will provide some insights into the interrelationships between the stock market and the rest of the economy. The econometric model, which is

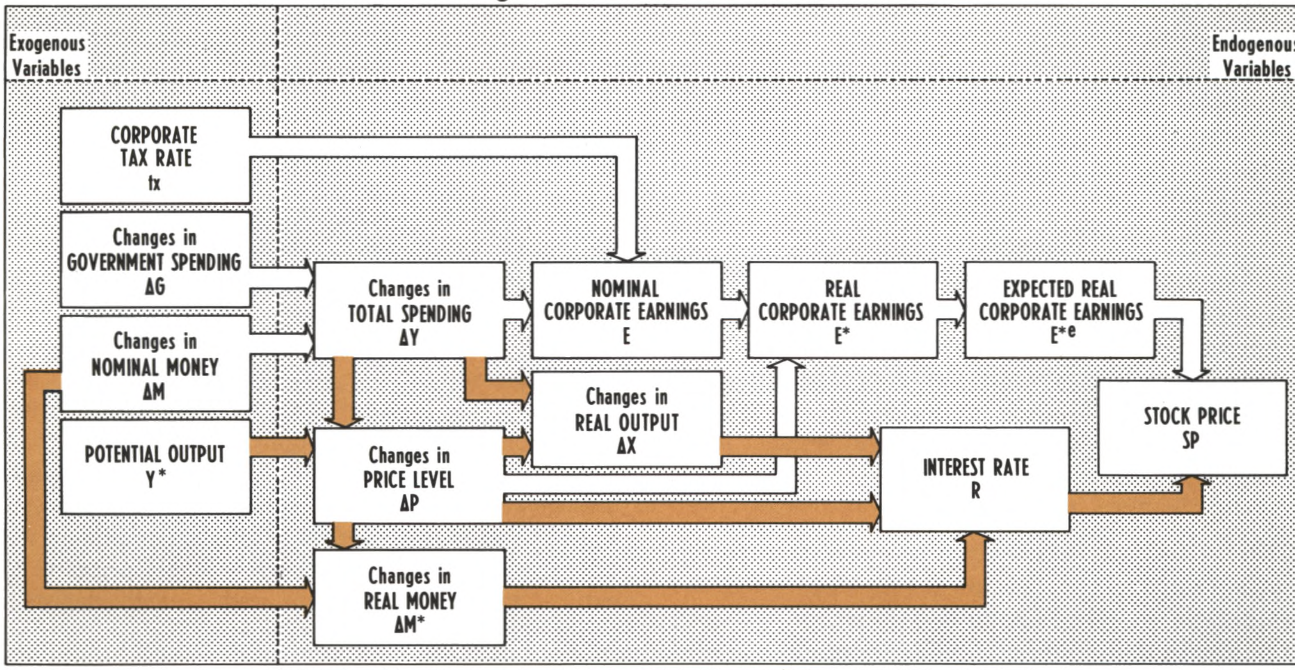
[25]These relationships are derived from the beta coefficients of the respective variables: $\dot{M}^* = .20$, $E^* = 1.65$, $\dot{P} = -.90$.

[26]The stock price estimates in III/1970 and IV/1970 were derived from the coefficients estimated through II/1970.

[27]The ability of stock price equation (16) to pick the major quarterly movements from I/1956 to I/1970 would indicate that other "famous" random shocks to the stock market have tended to average out over a quarter.

Exhibit I

Flow Diagram of Stock Price Determination



Note: For a complete flow diagram of the St. Louis model, see "A Monetarist Model for Economic Stabilization," this Review (April 1970), p.10. In the flow diagram above, changes in real output (ΔX), the price level (ΔP), and real money (ΔM*) affect the interest rate (R), which then affects the stock price (SP). This flow sequence is designed to show the logic of the relationships rather than the actual method of simulation. The simulation experiments described in the text are based on the stock price equation 16, where the interest rate variable is not included directly in stock price formation. Changes in X, P, and M* affect the stock price directly rather than indirectly through the interest rate. It must be remembered, however, that these variables operate conceptually through the interest rate, as shown in the flow diagram.

used to link the stock market to the rest of the economy, is the one developed by Andersen and Carlson and published in this *Review* in April 1970. It is small by the standards of most econometric models, containing only eight equations. However, it includes all of the variables that are necessary to experiment with our stock market "sub-model."

Linking with St. Louis Model — Before describing the simulation experiments relating the stock market submodel to the econometric model, it would be useful to consider the linkages implied by tying the models together. Schematically, the link with the econometric model is illustrated in the Exhibit above.[28]

There are three independent or exogenous policy variables in the combined model: monetary policy measured by changes in nominal money (ΔM), and fiscal policy measured by changes in government expenditures (ΔG), and the tax rate on corporate profits (tx). There is one nonpolicy exogenous variable, the capacity of the economy (Y*), which is estimated by the Council of Economic Advisors to grow at about a 4 per cent annual rate. All the other variables are determined within the model and are called dependent or endogenous variables.

[28]For a complete description of the model see Andersen and Carlson, pp. 7-25. Each equation in this article was re-estimated using the November 1970 revision of the money stock series.

There are two channels by which the exogenous policy variables (ΔM and ΔG) affect stock prices. First, changes in money and Government expenditures will affect total spending (ΔY). The current level and lagged changes in total spending plus the current corporate tax rate (tx) determine nominal corporate earnings (E). Real earnings (E*) are derived by deflating nominal earnings by the price index (P). Current and lagged values of real earnings generate expected real earnings (E^{*e}) which, in turn, will have a positive influence on the stock price (SP).

The other influence of the policy variables (ΔM and ΔG) operates through interest rates. The change in total spending (ΔY) induced by the change in money and government spending, combined with the initial conditions with respect to capacity of the economy (Y*) and past changes in prices, will determine current changes in prices (ΔP). The difference between current changes in total spending (ΔY) and current changes in prices (ΔP) will determine current changes in real output (ΔX). Current and past changes in real output and prices will generate expectations about inflation and real growth, which will in turn influence the current rate of interest (R). The interest rate is also influenced by current changes in real money (ΔM*). Finally, interest rates will have a negative influence on the stock price (SP).

In the following experiments we will be interested to see whether, by merely manipulating the exogenous policy variables in the model, nominal money, government spending, and the corporate tax rate, combined with the initial conditions at the beginning of each experiment, we can simulate the actual movements in the stock price index over an extended time period.

The stock price equation has been estimated with two different specifications. In equation (7) it is estimated on the basis of interest rates and expected corporate earnings. An equivalent specification is given in equation (16) as a semi-reduced form. In this case, rather than directly employing interest rates to determine stock prices, the factors which affect interest rates, as specified in equation (13), are used to estimate the stock price.

The stock price specification in equation (16) has a number of desirable statistical properties which are not present in the stock price estimate in equation (7). The Durbin-Watson (D-W) statistic in equation (16) indicates the absence of autocorrelation in the error term. The D-W statistic in equation (7) implies the existence of autocorrelation. This means that the estimated value of stock prices in equation (16) does not deviate consistently on one side or the other from the actual value of stock prices, while in equation (7), such a deviation does exist.

In addition, the standard error of equation (16) is only about half as large as the standard error of equation (7); 2.49 versus 4.70. This means that 64 per cent of the time (one standard deviation), the estimated value of the stock price is within 2.49 points of the actual value of the stock price in equation (16). By contrast, in equation (7), in 64 per cent of the observations the estimated value of the stock price is within 4.70 points of the actual value.

For these reasons the *ex post* and *ex ante* simulations presented below will be conducted using the coefficients estimated in equation (16).

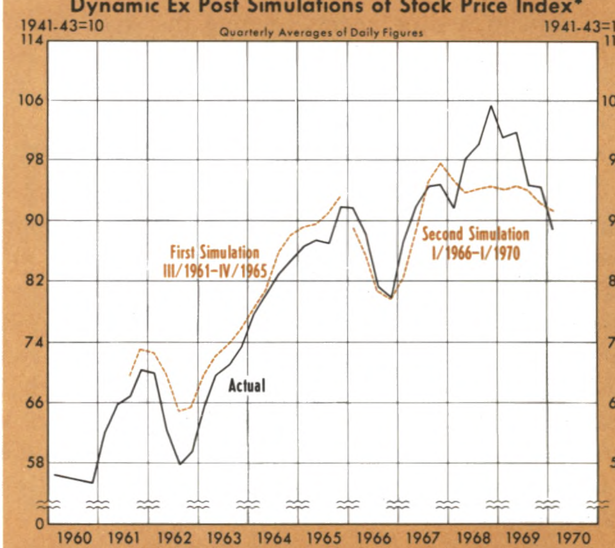
Dynamic Ex Post Simulations – *Ex post* simulation experiments are conducted within the data period used to estimate the equations. For example, in the model used here (and illustrated in Exhibit I), the shortest data period is for the stock price equation (I/1956 through II/1970). Therefore, the *ex post* simulations are conducted within this time span. The variable we wish to simulate is the stock price. Only the actual values of the policy variables (ΔM, ΔG, and tx) are fed into the computer and, when combined with the estimated coefficients (which are given as "detailed results"), simulated values of endogenous variables are generated in the same sequence of cause and effect as described in Exhibit I. A comparison of the simulated values for the stock price with actual values enables one to judge how well the complete model performs as an integrated unit.

The time spans selected to conduct the dynamic *ex post* simulations were designed to represent diverse periods in the United States economy. The first dynamic *ex post* simulation was III/1961 through IV/1965, and the second from I/1966 through I/1970. During the first time span, the economy went from early stages of economic recovery with relatively high unemployment and stable prices, to a period of economic boom and a decline in the unemployment rate below 4 per cent. In the second time span, the economy went from the stage of economic boom with low unemployment and relatively stable prices to the early stages of a recession with a high degree of inflation.

During both of these time spans there were major rises and falls in the stock price. A good test of the relevance of our model with respect to the stock market would be its ability to "track" the movement in the stock price index against the background of such diverse general economic conditions.

Both *ex post* simulations are illustrated in the chart below. The simulation starting with III/1961 tracks the last stages of the rising bull market, picks the peak in the first quarter of 1962, and the decline in stock

Dynamic Ex Post Simulations of Stock Price Index*



*Standard & Poor's Index 500 Stocks, 1941-43=10
These simulations are based on equations 15 and 16, described in the text, as well as on updated estimates of the St. Louis Model described in the text and published in this Review, April 1970.
Source: Standard & Poor's Security Price Index Record, 1970 Edition; Standard & Poor's Current Statistics, monthly.

prices in the second and third quarters of 1962. However, it overstates the stock price index at both the peak and trough. The simulation does a good job of measuring the rising market from early 1963 through 1965.

The second dynamic *ex post* simulation starts with the first quarter of 1966 and continues through the first quarter of 1970. It accurately tracks the decline in the stock price through the fourth quarter of 1966 and its recovery during 1967. However, it does not capture the rise in the stock price which occurred after the first quarter of 1968. Again, it does a reasonable job of tracking the moderate decline in the stock market in the last half of 1969 and the first quarter of 1970.

In general, we can see that these dynamic *ex post* simulations tended to track the major turning points in the stock market rather well, and were moderately successful in indicating the size of movements in the stock price after each turning point.[29] Moreover, it is only two years after the beginning of a simulation that errors tend to become large.

Dynamic Ex Ante Simulation — The acid test of any economic model is its ability to forecast the future. This test can be performed experimentally by what is called a dynamic *ex ante* simulation. This operates in much the same way as a dynamic *ex post* simulation, with one significant difference. The *ex ante* simulation predicts values of the stock price index beyond the time period in which the model was statistically estimated.

The statistical estimates of the model presented in this article were performed with data through II/1970. To perform dynamic *ex ante* simulations, therefore, it was necessary to re-estimate all of the equations in the stock market model and in the larger St. Louis econometric model with data through shorter time periods. In this way it would be possible to compare the *ex ante* simulation with the actual movements in the stock price index.

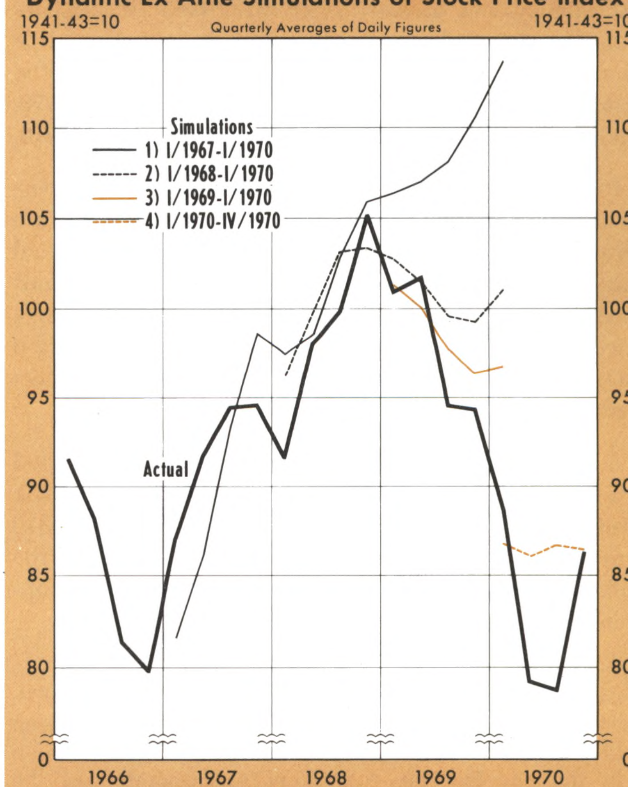
[29]More technically, this can be seen from the fact that the standard error of equation (16) was 2.49, while the standard error of dynamic ex post simulations are higher. The first simulation (III/1961 through IV/1965) had a standard error of 3.9, and the second simulation (I/1966 through I/1970) had a standard error of 4.7. This indicates that the simulated value of the stock price (which uses the simulated values for all the variables in the stock price equation, equation 16) gives a less accurate measure of the stock price than the estimated equation, using the actual variables. This result, of course, is not surprising. It reminds us that simulations of this type are of use in picking turning points in the stock price, but are less reliable in measuring the quarter-by-quarter movement in stock prices.

Four dynamic *ex ante* simulations are performed. For each *ex ante* simulation all of the coefficients in the model were re-estimated with data through four different terminal dates, IV/1966, IV/1967, IV/1968 and II/1970. With these different sets of model estimates, four alternative *ex ante* simulations of the stock price index were made:

1) *ex ante* simulation from I/1967 to I/1970.
2) *ex ante* simulation from I/1968 to I/1970.
3) *ex ante* simulation from I/1969 to I/1970.
4) *ex ante* simulation from I/1970 to IV/1970.

The results of these *ex ante* simulations are presented in the chart below. Simulation 1 (which is based on coefficients estimated with data through IV/1966 and simulates the stock price from I/1967) accurately measures the rapidly rising market in the four quarters of 1967. It picks the small decline in first quarter of 1968 and the rise for the rest of the year. For 1969 and 1970, however, this first simulation trails upward while the actual stock price falls substantially. The accuracy of this dynamic *ex ante* simulation diminishes

Dynamic Ex Ante Simulations of Stock Price Index*



*Standard & Poor's Index 500 Stocks, 1941-43=10
These simulations are based on re-estimates of equation 15 and 16 in the text: simulation 1 is based on coefficients estimated with data through IV/1966; simulation 2 through IV/1967; simulation 3 through IV/1968; and simulation 4 through IV/1969. Comparable re-estimates of the St. Louis Model were also used for these simulations.
Source: Standard & Poor's Security Price Index Record, 1970 Edition; Standard & Poor's Current Statistics, monthly.

as we move more than eight quarters away from the initial point of the simulation.

In simulation 2 all of the coefficients of the model were estimated with data through IV/1967, and the simulation was commenced in I/1968. This second simulation tracks the stock price rise during 1968 and, contrary to simulation 1, it also tracks the decline in 1969; however, it tended to understate the magnitude of the fall.

In simulation 3, all of the coefficients in the model are estimated with data through IV/1968, and the simulation starts with I/1969. This simulation indicates a decline in the stock price during the four quarters of 1969. It measures the magnitude of the decline better than simulation 2, but still understates it.

In simulation 4, all of the coefficients are estimated through II/1970 and the simulation runs from I/1970 through IV/1970. It differs from other simulations in that it is a combination *ex post* and *ex ante* simulation. The simulation is reasonably accurate at forecasting I/1970 and IV/1970, but overstates II/1970 and III/1970 by a substantial margin. The cause of this discrepancy has already been discussed. It appears that investor behavior (estimated in equation 16), which dominated stock price movements since the middle 1950's, broke down in II/1970 and III/1970, but apparently resumed its previous pattern in IV/1970.

In general, these *ex ante* simulations tend to perform well in the first four to eight quarters after they are started, but then gradually drift away from the actual value of the stock price. Considering that the periods used for the simulations were those in which stock prices reached highs not observed in the data period used to estimate the coefficients, the simulations performed relatively well.

A final dynamic *ex ante* simulation is conducted using coefficients estimated with data through II/1970. Simulations are conducted for the period IV/1970 through IV/1972. Because the actual value of the policy variables is unknown, the following assumptions are made:

(1) The corporate tax rate is assumed to be unchanged from the level of the third quarter of 1970. (At this printing, depreciation allowances have been liberalized, effective January 1, 1971. This reduction in the effective tax rate is not incorporated in the accompanying stock price simulations;)

(2) The growth in Government spending through the second quarter of 1971 is estimated from the Government budget. Thereafter, it is assumed to grow at a 6 per cent annual rate;

(3) The money stock is assumed to grow at four alternative rates: 0 per cent, 3 per cent, 6 per cent, and 9 per cent.

Because changes in the nominal money stock is the most significant policy variable in the model, it is the only one which is postulated at alternative growth rates.

These *ex ante* simulations should not be treated as exact forecasts of stock prices. There are some important factors which would make the actual stock price movement substantially different from any one of the simulated stock price movements.

First, all of these results are based on quarterly averages of the stock price, and movements in the stock price in any one week or month can deviate significantly from a quarterly average value. For example, on a monthly basis the most recent trough in the stock index was May 1970. However, on a quarterly average basis, the trough occurred in III/1970.

Second, the simulations are based on assumed constant rates of growth in the major policy variable (money). However, there in fact can be substantial variance in the growth of money, either because economic policy may change, or because of random factors which may influence the quarter-to-quarter pattern of money growth. If money should grow at a steady 3 per cent annual rate from I/1971 to IV/1972, the simulated stock price is as predicted in the table below. However, if money growth should vary between 6 per cent and 0 per cent, with an average of 3 per cent, the simulated stock price movement would be substantially different.

Third, the *ex ante* simulation is based on the assumption that the average economic behavior of the

DYNAMIC EX ANTE SIMULATIONS OF STOCK PRICE INDEX[1]

	Alternative Rates of Money Growth			
Quarter	0%	3%	6%	9%
1970/IV	84.3	85.9	87.5	89.1
1971/I	82.2	85.5	88.7	91.9
II	79.9	84.2	88.4	92.6
III	76.1	80.9	85.6	90.3
IV	75.5	80.6	85.6	90.5
1972/I	78.6	83.4	88.1	92.7
II	81.4	85.5	89.5	93.4
III	84.1	87.5	90.8	94.0
IV	85.5	88.3	91.1	93.5

[1]Levels of Standard & Poor's Index 500 Stocks, 1941-43 = 10.

Note: Projections are based on equations (15) and (16) in the text, and on the St. Louis Model.

past fifteen years will continue into the future. If there is a major structural shift in investor behavior from that implied in equation (16) (as temporarily occurred in II-III/1970), then these *ex ante* simulations will provide misleading predictions.

Finally, simulations are generally better at picking the timing of a turning point in the stock price than indicating the size of the movement after the turning point.

Conclusion

The intent of this article is threefold. First, it seeks a rational explanation for movements in stock prices which is consistent with standard economic price theory, and which can be tested against historical observations. It is shown that the standard theory of stock price determination, that is, discounting to present value expected future earnings, provides a solid theoretical base for a reasonably good empirical explanation of stock price movements in the past fifteen years. The major factors determining stock prices are shown to be expected corporate earnings and current interest rates. The interest rate in turn is determined by expectations of inflation, the real growth rate, and the change in real money. Increased earnings expectations tend to increase the stock price, while increased interest rates tend to depress the stock price. According to this analysis, changes in the nominal money stock have little direct impact on the stock price, but a major indirect influence on stock prices through their effect on inflation and corporate earnings expectations.

The second objective of this article is to test the interrelationships between the stock price hypothesis and a monetarist econometric model of the United States. By integrating the stock price submodel into the monetarist model to obtain a combined model, it is possible to better understand the link between Federal Reserve actions (measured by changes in the nominal money supply) and the resulting effect on the stock and bond markets.

A final objective is to illustrate how a small monetarist econometric model can be used to analyze subsectors of the economy. In this regard, the article can be viewed as an application of a monetarist model to issues with which the model was not originally intended to deal. The fact that it has worked with relative success provides further evidence on the usefulness of the monetarist model and its potential for further application in explaining other subsectors of the economy.

This article is available as Reprint No. 63.