The Response of Stock Prices to Changes in Weekly Money and the Discount Rate

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CONSIDERABLE research has been devoted to analyzing the effects of weekly changes in the money stock (M1) on interest rates and exchange rates.[1] In general, the results of this research are consistent with the efficient markets hypothesis, which holds that only unexpected changes in the money stock should significantly affect interest rates and exchange rates.[2] Few of these studies, however, have investigated the reaction of stock prices to the weekly money announcement.[3] The purpose of this article is to provide some evidence on this effect.

This paper extends previous research on the reaction of stock prices to monetary "news" in several ways. First, it covers a broader time period, from September 1977 through December 1984, than most previous studies. This allows one to test whether the changes in monetary policy operating procedures in October 1979 and October 1982 influenced the response of stock prices to changes in the money stock and the discount rate.[4]

Second, unlike previous studies, this study uses both broad and industry-specific measures of stock prices to determine if general market effects also occur uniformly across in specific industry groups.[5] As noted by King (1966):

> ". . . it is intuitively appealing to think of incoming information as falling into various classes according to the scope of its effect on the market. There is some news of a monetary nature, for example, which is bound to have a market-wide impact on security price. The magnitude of impact need not, however, be the same for all stocks." (p. 140)

Although numerous studies have attempted to determine optimal groupings of individual stocks based on their relative movements over time, little has been done to investigate the relative response of different stock groups to the same piece of economic information.

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[1]The surveys by Cornell (1983) and Sheehan (1985) contain numerous references to the literature on this subject.

[2]Alternative evidence is presented in Hein (1985), and Falk and Orazem (1985).

[3]Pearce and Roley (1983, 1985) find that stock prices react only to unanticipated changes in money and, for the most part, show no statistical relationship to either unanticipated or expected movements of other economic news. Hardouvelis (1985) reports that stock prices react to unanticipated movements in four monetary measures (M1, net free reserves, the discount rate and the discount rate surcharge), as well as three non-monetary measures (trade deficit, unemployment rate and personal income). Although few studies have examined the weekly money/stock-price relationship, numerous studies have studied the longer-term reaction of stock prices to movements in money. Among others, see Sprinkel (1964), Rozeff (1974), Sorensen (1982) and Davidson and Froyen (1982).

Various studies also have examined the behavior of stock prices to announcements of different types of information. For example, Schwert (1981) examines the reaction of stock prices to the announcement of inflation data; Fama, et. al. (1969) study the effects of stock splits; Lloyd-Davies and Canes (1978) investigate the effects of stock analysts' published recommendations; and Niederhoffer (1971) analyses the reaction of stock prices to "world events."

[4]A discussion of the October 1982 change in policy procedures can be found in Wallich (1984) and Gilbert (1985).

[5]Most previous research focuses solely on the broad market effects. For example, Pearce and Roley (1983) use the Dow Jones Industrial Average while Pearce and Roley (1985) use the Standard and Poor's 500 index. In an approach similar to that used in this study, Hardouvelis examines the effect of new information on several different stock price measures.

Finally, unlike most previous work, which presumed that the reaction of stock prices was symmetric with respect to unanticipated increases or decreases in money, this paper tests for the separate effect of positive and negative unexpected changes in M1. This permits one to test for market efficiency in a somewhat different manner than simply testing for the significance of expected and unexpected changes in money.[6]

THEORETICAL MODELS OF STOCK PRICE RESPONSE TO MONETARY NEWS

The efficient markets hypothesis suggests that, when expected changes in the money stock occur, they have no significant effect on stock prices because they already have been incorporated into security prices. Only unexpected changes in the money stock affect stock prices according to this hypothesis.[7]

Weekly Money Changes

Several hypotheses have been suggested to explain why stock prices react to unexpected changes in the money stock.[8] The *expected inflation hypothesis* suggests that an unexpected increase in the money stock increases market participants' expectations of inflation, leading to higher interest rates via the so-called Fisher effect. If the increase in interest rates lowers the present value of corporations' discounted cash flows, stock prices will fall whenever investors observe an unexpected increase in the money stock. This hypothesized response does not occur, however, under certain restrictive conditions. Given perfect markets and no taxes, for example, changes in expected inflation would have no effect on stock prices, because expected increases in nominal cash flows would offset the effect of increases in the rate at which those flows are discounted.[9] A large literature addresses these conditions, showing that they generally are not fulfilled.[10] Based on these studies, which indicate that stock prices react negatively to inflation, the expected inflation hypothesis suggests that stock prices should fall following the announcement of an unexpected increase in the money stock.

An alternative hypothesis, the *policy anticipations hypothesis*, views an unexpected change in the money stock as a signal that alters market perceptions of future monetary policy. Presuming that the change is perceived as permanent or that the Federal Reserve is slow to respond to unexpected deviations in the money stock away from its target level, interest rates will rise as the public expects the Fed to offset the unexpected increase in the money stock. Consequently, an unexpected increase in the money stock implies greater future tightening of credit availability, which results in higher interest rates. Because the higher interest rates reduce the present value of discounted cash flows, stock prices are hypothesized to decline.

Finally, the *money demand* or *real activity hypothesis* asserts that money announcements provide information about future money demand. Suppose that market participants interpret an unexpected increase in the money stock as a signal that there has been a permanent increase in money demand. If money demand depends on expected future output, then the unexpected increase in money demand indicates that future output will be higher than previously expected.[11] Consequently, the increase in expected cash

[6]Cornell, Pearce and Roley (1985) and Hardouvelis provide no evidence on this issue as it relates to stock price effects. Pearce and Roley (1983) present evidence on the response of stock prices when money deviates from announced long-run target ranges. Their tests are based on separating unanticipated money into positive surprises above target, negative surprises below target and all others. In general, their results indicate that the different surprise measures are not statistically different in their effect. There is, however, some evidence of a different effect of positive surprises across the different policy regimes.

[7]As Sheehan (1985) notes, the unexpected change in the money stock provides new information about money stock developments that already have occurred. That is because the money stock is announced with a lag. Thus, the announcement causes market participants to revise their forecasts for future policy actions apart from previously held expectations only if the announced money stock change is different from its expected change.

[8]This discussion is based on Cornell and Sheehan.

[9]This discussion abstracts from the distinction of net monetary creditors and net monetary debtors. For a discussion of the effects of changes in inflation expectations on each group, see Kessel and Alchian (1962). For a more recent study of the effects of inflation on bank stock prices, used to represent a group of net monetary creditors, see Santoni (1986).

[10]For example, Feldstein (1980) discusses the effect of taxes; Schwert (1981), Fama and Schwert (1977) and Nelson (1976) examine the inflation-stock price relationship for the United States while Branch (1974) and Cohn and Lessard (1981) provide evidence from other countries. In general, these studies indicate that unexpected increases in inflation lower stock prices. Results reported in Kool and Hafer (1986), however, suggest that this result does not hold for earlier time periods.

[11]Fama (1981) argues that expected inflation in previous studies serves as a proxy for expected real activity. Consequently, regressing stock prices on expected inflation without accounting for expected real activity will yield incorrect estimates. Following this line of reasoning, several researchers have used available survey data to study the relationship between expected stock price changes, expected inflation and expected real activity. See, for example, Gultekin (1983), Pearce (1984), Hasbrouck (1984) and Coate and VanderHoff (1985).

flows produces an increase in stock prices.[12] This hypothesis thus predicts that stock prices should increase in response to an unexpected increase in the money stock.

Discount Rate Changes

Discount rate changes may be thought of as an indication of changes in expected future monetary policy; discount rate changes, in other words, affect financial and stock markets primarily through their effect on interest rates and perceptions of future economic activity.[13] In general, increases in the discount rate reduce stock prices because they presage a tightening of monetary policy.[14] The move toward tighter policy is expected to increase interest rates and reduce real economic activity and, consequently, future corporate cash flows. Stock prices decline because the reduced future cash flows are discounted at higher interest rates.

Some argue that the impact of a discount rate change depends on the Federal Reserve's current operating procedure.[15] If the Fed is targeting interest rates, changes in the discount rate may provide no information about future policy that is not already incorporated in interest rates. If the Fed is using a reserve growth operating procedure, however, changes in the discount rate influence interest rates. During the period covered by this study, three different operating procedures were used: interest rate targeting (pre-October 1979); nonborrowed reserves targeting (October 1979 to October 1982); and a borrowed reserves procedure, which tends to smooth movements in the funds rate more than nonborrowed reserves targeting (post-October 1982). The empirical tests below assess the different effects of discount rate changes under different policy procedures.

TESTS OF THE BASIC MODEL

The basic equation tested is:

$$(1)\quad \Delta SP_t = \alpha_0 + \beta_1 UM_t + \beta_2 EM_t + \beta_3 DR_t + \beta_4 DRS_t + \varepsilon_t,$$

where

ΔSP = the first-difference of the logarithm of the daily stock price index,
UM = the unexpected dollar change in M1,
EM = the expected change in M1,
DR = the change in the discount rate, and
DRS = the change in the discount rate surcharge.[16]

The efficient markets hypothesis suggests that the estimated coefficient on expected money changes (β_2) should be zero. If discount rate changes influence stock prices as hypothesized above, β_3 and β_4 will be negative. Finally, the expected sign of β_1 differs depending upon the hypothesis being tested. The policy anticipations and the expected inflation hypotheses suggest that it will be negative; the money demand hypothesis suggests that it will be positive.

Besides investigating the validity of several hypotheses regarding the effects of money stock and discount rate changes on stock prices, estimates of equation 1 can be used to test several other hypotheses as well: Are the effects of the explanatory variables statistically equal across different monetary policy regimes? Are the effects similar across stock price indexes? Are the effects of money stock changes on stock prices symmetrical, as generally is assumed?

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[12]It should be noted that attendant increases in the *ex ante* real rate are presumably more than offset by expected increases in future real economic activity.

[13]Batten and Thornton (1985) and Smirlock and Yawitz (1985), for example, each attempt to determine "technical" from "non-technical" changes in the discount rate. Batten and Thornton dichotomize discount rate changes into technical or policy-related, based on Federal Reserve statements. Their procedure assumes that the change is entirely technical or policy-related.

Smirlock and Yawitz attempt to define technical and non-technical discount rate changes by regressing rate changes on lagged values of the spread between the federal funds rate and the discount rate and lagged values of changes in discount window borrowing. Predicted values from this equation constitute the technical (or anticipated) change, while the regression's error term constitutes the non-technical (or unanticipated) change in the discount rate.

Several factors militate against this procedure. First, it does not capture effects not incorporated in the explanatory variables. Second, it may alter the timing of the actual change. Last, it assigns each discount rate change, which generally is 25, 50 or 100 basis points, some estimated value that often does not equal the actual value. In other words, there is always some non-technical change.

Because of the problems surrounding these classifications of discount rate changes, we take the changes to be unanticipated.

[14]There are instances, however, when moves to raise the discount rate have been received by the market as *good* news, precipitating increases in stock prices. This is discussed in the shaded box on the next page.

[15]For example, see Roley and Troll (1984) or Smirlock and Yawitz for a discussion of this point.

[16]The discount rate surcharge was used by the Federal Reserve during the period from March to May 1980 and again during the period from November 1980 to November 1981. The 1980 imposition of the surcharge was part of the credit restraint program enacted by the Carter administration and it was set at 3 percent. During each period when the surcharge was used, it applied to discount window borrowings by banks with deposits of $500 million or more that borrow frequently. Because the surcharge did not apply to all borrowing, it is included as a separate variable in the regression equations presented below.

Timing Discount Rate Changes

Studies using discount rate changes often take the announcement date as the day it becomes "public." How one times the publication of the new information, however, may alter the empirical results. For example, there are occasions on which discount rate changes are announced *during* the trading day and, as such, the actual announcement day will differ from the day it is reported by the financial press. Because of this, we enter the discount rate change on the trading day that the change becomes effective.

To illustrate how sensitive the results are to changes in the timing, the SP500 equation was re-estimated for the pre-October 1979 period, defining the announcement date as that day when the discount rate change appeared in the the *Wall Street Journal*. An examination of the data revealed that, on Friday, November 1, 1978, the discount rate was raised 100 basis points *during* the trading day. Accounts in the *Wall Street Journal* on Monday attribute the stock price rally on Friday to the announcement, suggesting that the increase in the discount rate reaffirmed the market's perception that the Fed was resolved to rein in money growth and to reduce the possibility of future inflation. If we change only this one announcement date from the day it became effective (Friday) to the day it appeared in the *Wall Street Journal* (Monday), the estimated relationship becomes

$$\Delta SP500_t = \underset{(1.14)}{0.04} - \underset{(2.18)}{0.098}\, UM_t - \underset{(2.05)}{0.872}\, DR_t$$

$$\bar{R}^2 = 0.015 \quad SE = 0.713 \quad DW = 1.68$$

Two points should be made. First, the use of the effective day is theoretically preferable to dating the announcement by its appearance in the financial press. Second, the empirical effects of discount rate changes on stock prices appear to be quite sensitive to small timing changes. In this example, changing one observation reverses the sign and significance of the discount rate variable.

To assess these questions, equation 1 was estimated using daily stock price data from September 23, 1977, through December 31, 1984. Three zero-one dummy variables were used to differentiate the periods associated with alternative monetary policy regimes. Thus, D1 = 1 from September 23, 1977, through October 5, 1979, zero elsewhere; D2 = 1 from October 5, 1979, through October 15, 1982, zero elsewhere; and D3 = 1 after October 15, 1982, zero elsewhere. Interaction terms are formed by multiplying each explanatory variable by these dummy variables.[17] For example, D1UM represents the effect of UM in the first subperiod, D2UM the effect during the second and so on. Table 1 presents the results of estimating equation 1 using these interaction terms and the various stock price indexes.[18]

As the efficient markets hypothesis predicts, the expected change in M1 (EM) does not significantly affect stock price changes. The results in table 1 indicate that none of the 15 estimated coefficients on expected money is statistically significant at the 5 percent level of significance. The test results in table 2 also bear out the efficient markets hypothesis, as the reported F-statistics cannot reject the hypothesis that the coefficients on the expected change in money together are insignificantly different from zero. Thus, the hypothesis that the estimated coefficients on expected money are zero *across the different monetary regimes* is not rejected by the data.

As predicted by the expected inflation and policy anticipations hypotheses, but counter to the money

[17]Because the discount rate surcharge variable enters only during the second subsample, no interaction term is necessary. Also, the choice of October 15 for the 1982 policy change is arbitrary, since published accounts of the procedural change do not provide an exact date.

[18]Note that equation 1 is estimated without day-of-the-week variables. Previous analysis by Pearce and Roley (1985) using the same data finds that the presence or absence of these variables did not influence their results. Given this evidence and the fact that we are using the same data, we also omit day-of-the-week variables. Other evidence on the existence of day-of-the-week effects, much of it conflicting, are reported in French (1980) and Gibbons and Hess (1981).

Following Pearce and Roley (1985) and Hardouvelis, we also included several other measures of economic "news" as explanatory variables in equation 1. Those results indicated that stock prices, irrespective of the index, responded to monetary announcements more reliably than the other measures, such as unexpected inflation, economic activity or unemployment. Because the results of these tests do not extend the analysis already provided by Pearce and Roley, we do not report them here.

Table 1
Estimates of Equation 1

	Index				
Variable	**SP500**	**SP400**	**SPTRAN**	**SPUTIL**	**SPFIN**
Constant	0.025	0.025	0.027	0.012	0.018
	(1.20)	(1.14)	(0.98)	(0.86)	(0.80)
D1UM	−0.100	−0.104	−0.164	−0.037	−0.060
	(1.81)	(1.81)	(2.29)	(1.02)	(1.03)
D2UM	−0.124	−0.120	−0.067	−0.129	−0.149
	(3.84)	(3.58)	(1.60)	(6.05)	(4.37)
D3UM	−0.112	−0.114	−0.091	−0.119	−0.125
	(2.46)	(2.41)	(1.54)	(3.96)	(2.60)
D1EM	0.072	0.077	0.105	0.036	0.033
	(1.14)	(1.18)	(1.29)	(0.87)	(0.50)
D2EM	0.072	0.073	0.101	0.048	0.031
	(1.37)	(1.34)	(1.49)	(1.40)	(0.56)
D3EM	0.034	0.037	−0.021	0.022	0.094
	(0.74)	(0.77)	(0.34)	(0.72)	(1.92)
D1DR	0.916	1.038	1.189	0.259	0.944
	(1.77)	(1.91)	(1.76)	(0.76)	(1.72)
D2DR	−0.597	−0.599	−0.332	−0.282	−0.448
	(2.35)	(2.27)	(1.01)	(1.69)	(1.67)
D3DR	1.208	1.315	1.412	−0.269	0.336
	(1.54)	(1.61)	(1.38)	(0.52)	(0.41)
DRS	−0.432	−0.421	−0.501	−0.543	−0.658
	(2.66)	(2.48)	(2.36)	(5.08)	(3.83)
$\bar{R}^2$	0.020	0.018	0.009	0.039	0.021
SE	0.877	0.913	1.165	0.596	0.952
DW	1.79	1.82	2.00	1.98	2.01
ρ	—	—	0.19	0.26	0.23
			(8.31)	(11.36)	(9.88)

NOTE: Absolute value of t-statistics are reported in parentheses. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom; SE is the regression standard error; DW is the Durbin-Watson test statistic; and ρ is the estimate of the first-order serial correlation coefficient. The dependent variables are measured as first-differences of the logarithms of Standard and Poor's 500 (SP500), 400 stock index (SP400), the transportation index (SPTRAN), the utility index (SPUTIL) and the financial index (SPFIN). The right-hand-side measures are unexpected changes (UM) and expected changes in M1 (EM), based on the Money Market Services, Inc. survey. DR and DRS represent the percentage change in the Federal Reserve's discount rate and surcharge rate, respectively. The terms D1, D2 and D3 represent (0, 1) dummy variables where D1 = 1 from September 23, 1977, through October 5, 1979, 0 elsewhere; D2 = 1 from October 5, 1979, through October 15, 1982, 0 elsewhere; and D3 = 1 from October 15, 1982, to December 31, 1984, 0 elsewhere.

demand hypothesis, unanticipated changes in M1 (UM) generally have a statistically significant, negative impact on stock prices. For instance, an unanticipated $1 billion increase in M1 reduced the growth rate of the SP500 and the SP400 by about 10, 12 and 11 basis points across the three periods tested. The results in table 2 provide supporting evidence that unanticipated money stock changes do affect stock prices. The results on line 3 reject the claim that unanticipated changes in M1 have no effect; the results on line 4, which test the equality of the estimated coefficients across the different policy periods, indicate that one cannot reject coefficient stability at the 5 percent level. These results show that only unexpected changes in

Table 2
Hypothesis Test Results

Hypothesis	Index/F-statistics				
	SP500	SP400	SPTRAN	SPUTIL	SPFIN
D1EM = D2EM = D3EM = 0	1.23	1.24	1.33	1.08	1.41
	(0.30)	(0.29)	(0.26)	(0.36)	(0.24)
D1EM = D2EM = D3EM	0.19	0.17	1.20	0.16	0.46
	(0.83)	(0.84)	(0.30)	(0.85)	(0.63)
D1UM = D2UM = D3UM = 0	8.04	7.31	3.40	17.81	8.96
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
D1UM = D2UM = D3UM	0.08	0.03	0.68	2.48	0.88
	(0.92)	(0.97)	(0.51)	(0.08)	(0.42)
D1DR = D2DR = D3DR = 0	3.68	3.81	2.00	1.24	1.97
	(0.01)	(0.01)	(0.11)	(0.29)	(0.11)
D1DR = D2DR = D3DR	5.15	5.47	2.97	1.03	2.78
	(0.01)	(0.00)	(0.05)	(0.36)	(0.06)

NOTE: Marginal significance levels are reported in parentheses. Variable definitions are found in table 1.

money reliably influence the behavior of stock prices and that there appears to be no statistically significant change in this response across the different monetary policy regimes.[19]

The general hypothesis about discount rate changes on stock prices does not fare so well as the hypothesis about the effects of unanticipated changes in M1. Discount rate changes generally had a positive but not statistically significant (5 percent level) effect on stock prices before October 1979 and after October 1982. This result does not support the view that discount rate increases should negatively influence stock prices. It does, however, support the notion that, during periods in which monetary policy emphasizes the behavior of the federal funds rate, the discount rate may not impart relevant policy information not already contained in, for example, the federal funds rate.[20]

The results for the October 1979 to October 1982 period indicate that changes in the discount rate result in stock price movements generally consistent with the hypothesis described above. Changes in the discount rate have a significant (one-tailed) negative effect on all indexes during this period, except for the SPTRAN index. The size of the estimated coefficients, however, is lower for the more narrowly defined indexes than it is for the broad SP500 and SP400 measures. Thus, a 100 basis-point increase in the discount rate during this period led to a 60 basis-point decline in the growth rate of SP500 and SP400, but only a 28 basis-point drop in the growth rate of the SPUTIL index.

Why are the effects of discount rate changes so different across the different policy regimes? Prior to October 1979, movements in the federal funds rate directly conveyed information about changes in policy objectives, thus making the informational content of discount rate changes redundant.[21] A similar argument can be made about the post-October 1982 period, since the switch from a nonborrowed to a borrowed reserves targeting procedure is similar to a policy that smooths movements in the federal funds rate.[22] The finding that the estimated coefficients on

[19]This evidence is in sharp contrast to the results from studies examining the interest-rate/money relationship over this period.

[20]It should be noted that the discount rate changes during the pre-October 1979 period are positive and significant at the 10 percent level for all of the indexes except SPUTIL. For a possible explanation of this result, see the shaded insert on page 8.

[21]The evidence in the shaded insert on page 8 and accounts of discount rate changes in the *Wall Street Journal* do not support the gross generality of this view.

[22]If a borrowings target (referred to as the borrowings assumption) is used and the primary determinant of discount window borrowing is the federal-funds-rate/discount-rate spread, increases in the funds rate, ceteris paribus, necessitate an increase in reserves since borrowings will otherwise increase. Thus, reserves are injected, the funds rate falls and borrowings return to their desired level. This policy scenario suggests that movements of the federal funds rate after October 1982 again directly reflect policy objectives. For a more complete discussion, see Gilbert.

discount rate changes are insignificantly different from zero during the two different policy regimes suggests that the market's perception of changes in the discount rate may not be any different after October 1982 than it was before October 1979.

The test results in table 2 indicate that the discount rate change is an important variable in explaining the behavior of the broad indexes, but is less so for the more specialized groups. In fact, the reported F-statistic for the SPUTIL index indicates that we cannot reject the hypothesis that changes in the discount rate together have no significant effect. The test results also reveal that the effect of discount rate changes is not equal across regimes at reasonable levels of significance (except for SPUTIL).

Finally, the estimated coefficient on the discount rate surcharge (DRS) is highly significant and negative for each of the stock price indexes tested. The magnitude of the effect on the broad stock price measures is similar to that found by Pearce and Roley (1985); in addition, all of the stock price measures are affected. In fact, unlike the results for the discount rate, which tend to have a smaller effect on the narrower indexes, a change in the surcharge rate actually had a larger impact on the narrow indexes.

To summarize, the hypothesis that only unanticipated changes in money negatively influence the movement of stock prices cannot be rejected. This finding, which holds for most of the stock price indexes used and time periods tested, supports the efficient markets hypothesis, rejects the money demand hypothesis and corroborates earlier results based solely on the use of broad stock price indexes. It also shows that the effect of discount rate changes varies among the particular indexes and over the periods tested. Thus, although policy regime changes do not appear to influence the market's reaction to unanticipated changes in money, the evidence suggests that the information conveyed through discount rate changes varies across policy regimes.

Symmetry Hypothesis Tests

Analysts generally assume that positive and negative unanticipated changes in money have symmetrical influences on stock prices.[23] To test this hypothesis, we again use zero-one dummy variables to generate the appropriate interaction terms that differentiate positive and negative observations of UM.

Table 3 presents the results of this test. Positive values of UM are denoted by UM (+); negative values by UM (−).[24] Negative unexpected changes in money have no statistically significant effect on stock prices using the SP500, SP400 and the SPTRAN indexes. In each case, the reported t-values are quite small, as are the estimated coefficients. In tests of the equality of the coefficients on the positive and negative values of UM, we find that, for these three stock price measures, the t-statistics are large enough to reject equality at the 5 percent level. It appears that only positive values of UM have significant effects on changes in these stock prices; the growth rates of these indexes fell by 16 basis points for a $1 billion surprise in M1. This result suggests that market efficiency is violated.[25]

The SPUTIL and SPFIN results indicate that both positive and negative values of UM have similar, statistically significant effects on the stock price changes. In these instances, the calculated t-statistics to test coefficient equality are well below any acceptable level of significance. The symmetrical response of utility and financial stocks to an unanticipated increase or decrease in the money stock indicates that these stocks are relatively more sensitive to interest rate and price level movements than other stocks.

SUMMARY

The results of this study generally support the efficient markets hypothesis. Based on evidence from several different stock price indexes, unanticipated changes in money have a statistically significant effect on stock prices. Expected changes in money never display a statistically significant effect. The estimated effect of unanticipated changes in money did not differ across alternative monetary policy regimes. One

[23]Little research into the symmetry of the effects is available. Although Pearce and Roley (1983) and Roley and Troll (1983) test for the effects on interest rates when money changes are above or below stated policy targets, this does not directly address the hypothesis. Also, Pearce and Roley (1983) present similar tests for stock prices.

[24]Values of zero are included in the UM (+) data. Discount rate variables are omitted from the SPUTIL equation, because the evidence in table 2 indicates that they are not significant (jointly) at any reasonable level. It should be noted that reestimation of the equations in table 3 using a seemingly unrelated regression procedure does not alter the conclusions reached in this section.

[25]Gikas Hardouvelis, in private correspondence, suggests the following scenario. Consider the median forecaster facing the money announcement with equal probability that the announced M1 figure will be above or below the forecast. Given the results in table 3, the strategy is to sell before the announcement, since a positive surprise in money will lower stock prices while a negative surprise has no statistical effect. If such response persists, market efficiency is violated.

Table 3
Results for Symmetry Test

	Index				
Variable	**SP500**	**SP400**	**SPTRAN**	**SPUTIL**	**SPFIN**
Constant	0.048	0.049	0.067	0.024	0.040
	(2.18)	(2.16)	(1.90)	(1.20)	(1.32)
UM(+)	−0.162	−0.164	−0.166	−0.120	−0.153
	(5.07)	(4.93)	(4.01)	(5.75)	(4.56)
UM(−)	−0.046	−0.041	0.006	−0.086	−0.072
	(1.24)	(1.08)	(0.13)	(3.65)	(1.89)
D1DR	0.937	1.059	1.195		0.955
	(1.81)	(1.96)	(1.77)		(1.74)
D2DR	−0.604	−0.607	−0.340		−0.446
	(2.39)	(2.30)	(1.03)		(1.66)
D3DR	1.232	1.341	1.432		0.394
	(1.57)	(1.64)	(1.40)		(0.47)
DRS	−0.403	−0.391	−0.467	−0.551	−0.637
	(2.49)	(2.32)	(2.21)	(5.22)	(3.71)
t	2.48*	2.52*	2.75*	1.07	1.58
$\bar{R}^2$	0.022	0.021	0.015	0.039	0.025
SE	0.876	0.912	1.164	0.597	0.952
DW	1.79	1.82	2.00	1.98	2.01
ρ	—	—	0.19	0.27	0.23
			(8.38)	(11.73)	(9.94)

NOTE: The reported t-statistic is based on testing the hypothesis that UM (+) = UM (−). An asterisk denotes significance at 5 percent level. All other terms are defined in table 1.

result that does not support the efficient markets hypothesis is the finding that the effects of unanticipated money changes are asymmetric: only positive values of unanticipated changes in money appear to have a significant impact on the SP500, SP400 and SPTRAN measures.

The effects of discount rate changes on stock prices vary with changes in monetary policy procedures; their influence also lessened as the stock price index became narrower. In general, discount rate changes have significant negative effects on stock prices only from October 1979 to October 1982, a period characterized by a monetary policy that focused on controlling nonborrowed reserves. Before and after that period, discount rate changes convey little additional information about policy.

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APPENDIX
Data Definitions

Money

The expected change in the money supply (EM) is the median forecast obtained from Money Market Services, Inc. (MMS).

Since 1977 this firm has conducted a weekly telephone survey of 50 to 60 government securities dealers to obtain their forecast of the change in M1. Before February 8, 1980, the survey was conducted twice each week, initially on Tuesday, with a follow-up call on Thursday, allowing respondents to alter their original guess. From February 1980 through February 1984, however, the survey was conducted only on Tuesday, because of the Federal Reserve's shift in announcing the weekly M1 figures from Thursday to Friday afternoon. Beginning February 1984, which corresponds to the change from lagged to contemporaneous reserve accounting and with the announcement day again being changed from Friday to Thursday afternoon,

MMS once again used two surveys: the initial poll on the Friday immediately following the Thursday money announcement and again on the following Tuesday. For this study, we use the forecasts from the Tuesday survey. The data used here are those from Pearce and Roley (1985) as updated by Doug Pearce. We would like to thank him for making these as well as the actual M1 data available.

Actual changes in weekly M1, which appear in the Federal Reserve's H.6 statistical release, are measured as the first announced value minus the first revised estimate of the previous week's level. Due to the changing definition of M1 during our sample, the following procedure was followed to obtain a series consistent with that being forecast by the survey respondents: Until February 1980, we use the old definition of M1. From February 1980 through November 1981, we use the actual M1B measure (not the M1B value that was "shift-adjusted" for the introduction of NOW accounts). Finally, from November 1981 through the end of our sample, we use the current definition of M1. Given the actual and expected series for money, unanticipated changes in M1 (UM) are measured as actual less expected.

Stock Prices

The stock price indexes used in this study are daily close values of the broad Standard and Poor's (SP) 500 and 400 indexes, as well as the industry-specific indexes for transportation (SPTRAN), utilities (SPUTIL) and financial institutions (SPFIN). In each instance, the stock price change is measured as the difference of the logarithms.

Discount Rate

Changes in the Federal Reserve's discount rate and the surcharge are measured in percentage points; that is, a 100 basis-point change in either rate is measured as 1.0. Our measurement of the discount rate change, unlike that in some studies, follows the Federal Reserve's official dating procedure, changing when one of the 12 Federal Reserve Banks has the approval of the Federal Reserve Board to change its rate. The data used here is based on the day the new rate is in effect, not when the new rate is announced in the financial press.