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FURTHER EVIDENCE ON STOCK PRICE
RESPONSE TO CHANGES IN WEEKLY
MONEY AND THE DISCOUNT RATE

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85-015

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1. INTRODUCTION

Much effort has been expended in analyzing the effect of unanticipated weekly changes in the M1 money stock on interest rates and exchange rates.^{1/} In general, the results do not reject the efficient markets hypothesis; that is, only unexpected changes in the money stock significantly effect interest rates and exchange rates.^{2/} In light of the importance of this work, there is surprisingly little research investigating the reaction of stock prices to the weekly money announcement. Indeed, the work by Pearce and Roley (1983, 1985), Hardouvelis (1985) and Cornell (1983) are notable exceptions. In their work, Pearce and Roley find that stock prices react quickly to only unanticipated changes in money and, for the most part, show no statistical relationship to the unanticipated or expected movements of other economic news.^{3/} Hardouvelis 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).

Our purpose is to focus on the analysis of the weekly money-stock price relationship. We extend previous work in several ways: First, our study uses an updated sample of observations. Because most previous studies' sample periods end in October 1982, testing for different response patterns across changing monetary regimes is limited to only the October 1979 change in operating procedures. Because our data sample runs from September 1977 through December 1984, we are able test for the

change in operating procedures that took place in October 1979 as well as October 1982.^{4/}

Second, we compare the effects of the weekly money announcement on several different stock price indexes. Pearce and Roley's (1983) analysis is based on the Dow Jones Industrial Average while Pearce and Roley (1985) use the Standard and Poor's 500 index. Because there appears to be no consensus about which index (if any) best represents the "market," it is unclear how robust the empirical results are across alternative stock price indexes.^{5/} Since new information may influence different stock groups in a non-uniform manner--for instance, financial stocks are likely to react more to changes in monetary policy news than, say, transportation stocks--we use five measures: Standard and Poor's 500, 400 industrial, transportation, utilities and financial indexes.^{6/}

Third, we present evidence from tests of two other hypotheses that largely have been ignored in this literature. One such hypothesis concerns the effects on money supply announcements and, hence, on the empirical results testing the money-stock price relationship, stemming from the existence of so-called social security weeks. There is evidence suggesting that the occurrence of such weeks influences not only the time-series properties of the weekly money series, but also the subsequent reaction of interest rates to unexpected changes in money.^{7/} Given such results, it is useful to determine if stock prices are similarly influenced.

Finally, most work--empirical and theoretical--presumes that the reaction of stock prices is symmetrical with respect to unanticipated increases or decreases in money. Although Roley (1983) presents some

evidence on the response of stock prices when money deviates from announced long-run target ranges, evidence bearing directly on the issue of symmetry is not presented.^{8/} In this study we explicitly test this hypothesis as it pertains to the reaction of stock prices.

The format of the paper is as follows: Section 2 provides a brief discussion of the theoretical arguments on the money-stock price relationship and presents the model to be tested. Empirical evidence from testing the model and the various hypotheses is presented in Section 3. Summary remarks close the paper in Section 4.

2. THE THEORY

The observed negative response of stock prices to the announcement of an unanticipated increase in the money stock found in previous studies is explained by several alternative channels of influence.^{9/} One suggested channel is the expected inflation hypothesis, where agents revise upward their expectations of future inflation given an unexpected increase in money. Unfortunately, the theoretical impact is ambiguous with respect to stock price reactions to unanticipated money changes. The ambiguity arises because of the uncertainty surrounding the degree of existing market imperfections, such as the existence of taxes (e.g. Feldstein (1980)). There does exist a substantial body of literature indicating that stock returns are negatively correlated with expected and unexpected inflation.^{10/} Thus, if agents do revise upward their inflation outlook given an unexpected increase in money, the evidence suggests that stock prices will fall for an unexpected increase in money.

An unexpected increase in money also may cause stock prices to fall through two other effects. One effect arises if the price level does not

respond immediately to the unexpected increase in money. Due to this lagged adjustment, real interest rates adjust to clear the money market. Thus, the ex ante real rate rises and, because the rate of discount is increased, stock prices are hypothesized to fall. The second effect has market participants' anticipations of future Fed policy changing given the occurrence of an unexpected increase in money.^{11/} Whether this latter influence takes place through the expectation of future tightening moves by the Fed to restore money growth to some desired path (thus causing interest rates to rise), or through the increased uncertainty surrounding future policy adjustments, the hypothesized effect is to decrease stock prices.

In addition to examining the impact of expected and unexpected money changes on stock prices, we also investigate the effect of changes in the Federal Reserve discount rate and the discount rate surcharge in the estimated model.^{12/} Changes in the discount rate generally are thought to reflect changes in monetary policy objectives. For example, an increase in the discount rate may reflect a policy desire to raise interest rates and slow money growth. Thus, an increase in the discount rate theoretically should induce a fall in stock prices.^{13/} Roley and Troll (1984) and Smirlock and Yawitz (1985) have presented empirical evidence suggesting that discount rate changes had statistically different effects before and after the October 6, 1979 shift in operating procedures. For example, each study finds little impact during the pre-1979 period, but a large negative response by stock prices after the policy shift. Because our sample period encompasses three different policy regimes during which changes in the discount rate may convey

different policy objectives to the market, it is useful to include this variable.

Given the preceding discussion, the equation to be estimated takes the form

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

where ΔSP is the first-difference of the logarithm of the daily stock price index, UM is the dollar measure of unexpected changes in $M1$, EM is the expected dollar change in $M1$, DR is the change in the discount rate and DRS is the change in the discount rate surcharge. Based on the efficient markets hypothesis, the estimated coefficient on EM ($\hat{\beta}_2$) should be zero. From our foregoing discussion, we expect $\hat{\beta}_1, \hat{\beta}_3, \hat{\beta}_4 < 0$.

3. EMPIRICAL RESULTS

Before turning to the discussion of our empirical results, it is useful to describe the data used in this study.

3.1. Data

3.1.a. Money Data

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 $M1$. Prior to February 8, 1980, the survey was conducted twice each week, initially on Tuesday with a follow-up call made 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 shift in the

Federal Reserve's announcement of the weekly M1 figures from Thursday to Friday afternoon. Beginning in February 1984, corresponding to the change from lagged reserve accounting to contemporaneous reserve accounting and with the announcement day again being changed from Friday to Thursday afternoon, MMS once again uses 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.^{14/}

Actual changes in weekly M1 are taken from the Federal Reserve's H.6 statistical release and are measured as the first announced value minus the first revised estimate of the previous week's level. Due to definitional changes in M1 during our sample, the following procedure was followed: until February 1980, we use the old definition of M1. Then, from February 1980 through November 1981, the money stock is defined as 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, the current definition of M1 is used.

Given the actual and expected series for money, unanticipated changes in M1 (UM) are measured as actual less expected.

3.1.b. Stock Prices

The stock price indexes used in this study are the broad Standard and Poor's (SP) SP500 and SP400 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 in the logarithms of the daily close. Because there appears to be no consensus on exactly which of the existing stock

market indexes best represents "the market," the use of alternative measures allows us to empirically determine if an unexpected change in M1 and discount rate equally influences alternative "markets." As noted by King (1966, p. 140),

"... 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 the impact need not, however, be the same for all stocks."

Thus, 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.^{15/}

3.1.c. 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 some studies, follows the Federal Reserve's guideline in that the rate changes when one of the twelve Federal Reserve Banks has the approval of the Federal Reserve Board to change its rate. Thus, the data used is based on the day the new rate is in effect, not necessarily when the new rate is announced in the financial press. Using the latter procedure may delay the market's actual knowledge of the change if there is a rate change before the market's close. Finally, discount rate changes are treated as unanticipated, although Smirlock and Yawitz (1985) suggest that this may not always be the case.^{16/}

3.2. Test Results

Estimates of equation 1 are used to test several hypotheses:

First, do anticipated and unanticipated money changes significantly effect observed changes in stock prices? Second, are the effects of the explanatory variables statistically equal across the different monetary regimes covered by our sample? Third, are the effects similar across stock price indexes? Fourth, are the effects of money influenced by the occurrence of so-called social security weeks? Last, are the effects of money changes symmetrical, as generally is assumed?

To test the first three of these hypotheses, equation (1) was estimated using observations from the sample period September 23, 1977 through December 31, 1984. Zero-one dummy variables were generated for the three subperiods associated with alternative monetary policy regimes. Thus, $D1 = 1$ for the period September 23, 1977 through October 5, 1979, zero elsewhere; $D2 = 1$ for the period from October 5, 1979 through October 15, 1982, zero elsewhere; and $D3 = 1$ for the sample period after October 15, 1982, zero elsewhere. Multiplying each explanatory variable by these dummy variables, interaction terms are formed.^{17/} For example, $D1UM$ represents the effect of UM in the first subperiod, $D2UM$ the effect during the second and so on. The results of estimating equation (1) using these interaction terms and for each stock price index are presented in Table 1.^{18/} Outcomes of testing the first two hypotheses discussed above are found in Table 2.

With regard to the hypothesis that expected money (EM) significantly affects stock price changes, the results in Table 1 indicate that only one out of 15 estimated coefficients on expected money

is statistically significant. That coefficient, the estimate for the post-October 1982 period using the SPFIN index, is positive and almost significant at the 5 percent level ($t = 1.92$). The rejection of the hypothesis is further supported by the test results in Table 2, where the reported F-statistics cannot reject the hypothesis that the coefficients on expected money are jointly not significantly different from zero. We also cannot reject the hypothesis that the estimated coefficients on expected money are zero across the different monetary regimes.

In contrast to the results for expected money, unanticipated changes in M1 (UM) generally have a statistically significant, negative impact on stock prices. Although this result holds for most stock price indexes, the results using SPTRAN stand out in sharp contrast. Using that stock price measure, unanticipated money's influence was greatest during the pre-October 1979 period and is only marginally significant thereafter.

Turning to Table 2, the hypothesis that unanticipated money influences stock price changes is not rejected at high levels of significance for each stock price index. The results from testing the equality of the estimated coefficients across the different samples also indicates that we cannot reject coefficient stability, except at the 8 percent level using the SPUTIL index. In general, the evidence supports the notion that only unexpected changes in money reliably influence the behavior of stock prices and there appears to be no statistically significant change in the response across periods.^{19/}

The outcome from estimating the effects of discount rate changes on stock prices is interesting for several reasons. In contrast to the

findings of Pearce and Roley (1985) and Smirlock and Yawitz (1985), we find a significant (10 percent level), positive effect from discount rate changes during the pre-October 1979 sample. This result holds for all of the indexes except SPUTIL where the estimated coefficient was not different from zero at any reasonable level of significance. Indeed, not only are the estimates significant, but they also are large in magnitude. In fact, in each instance we cannot reject the hypothesis that the coefficients equal unity.^{20/} Thus, a 100 basis point increase in the discount rate lead to a one-percentage point increase in the growth rate of stock prices.^{21/}

The results for the October 1979 - October 1982 sample suggest that increases in the discount rate result in stock price declines, as hypothesized above. While this qualitative result agrees with previous findings, note that the quantitative effect is not uniform across indexes. For example, changes in the discount rate have only a marginally significant effect on the SPUTIL ($t = 1.69$) and (surprisingly) SPFIN ($t = 1.67$) indexes during this period and no statistical impact on SPTRAN ($t = 1.01$). It also is interesting to note that the magnitude of the effect is lower for the more narrowly defined indexes relative to the broad SP500 and SP400. Thus, it appears that there is a non-uniform response to the information conveyed in discount rate changes.

The coefficient estimates for the post-October 1982 period again show positive effects of discount rate changes on the stock prices. During this period, however, there appears to be no statistically significant impact of these changes. The fact that the estimated coefficients on the discount rate change become positive during this

latter period is, perhaps, indicative of the information conveyed by such changes given the underlying monetary policy regime. As others have argued, 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.^{22/} During the period after October 1982, a similar argument can be made, since the switch from a nonborrowed reserves targeting procedure to one that focuses on borrowed reserves is tantamount to reverting back to a federal funds rate policy.^{23/} Thus, our finding that the estimated coefficients on discount rate changes are positive under the two supposedly "different" policy regimes suggests that the market's perception of policy announcements via changes in the discount rate may not be any different during the post-October 1982 part of the sample than during the pre-October 1979 period when policy aimed directly at controlling the federal funds rate.

Not surprisingly, the hypothesis test results in Table 2 indicate that the discount rate change is an important variable in explaining the behavior of the broad indexes, but 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 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 is negative and highly significant for each stock price measure. The magnitude of the effect is close to that found by Pearce and Roley

(1985). Although their estimate achieves significance only at the 10 percent level, our's is easily significant at the 5 percent level.

To summarize, we cannot reject the hypothesis that only unanticipated changes in money influence the movement of stock prices. This finding, which holds for most of the different stock price indexes used and time periods tested, supports the efficient markets hypothesis and corroborates earlier results based solely on the use of broad stock price indexes. We also have shown that the effect of discount rate changes varies among the particular indexes used here 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.

3.2.a. Alternative Hypothesis Tests

We now extend the analysis to test for the possible effects that so-called social security weeks may have on the analysis.^{24/} It has been shown that the occurrence of these special weeks not only influences the characteristics of the weekly money time series (Hafer (1984)), but also that incorporation of these observations in studies of interest rate responses to weekly money announcements yield results different than when they are treated separately (Clark, et. al. (1985), Schmidt and Haddad (1985)). Because of such results, it is useful to investigate the possible effect that these observations may have on the results reported thus far.

To capture the effects of social security weeks, a zero-one dummy variable was used. Taking on a value of one if the money change occurred

on a social security week, the dummy variable was used to form interaction terms to be added to the equations derived from the analysis in Tables 1 and 2. Thus, unanticipated money is redefined as SSUM when it takes place during a social security week and UM otherwise.

The results of estimating equation (1) modified to test for social security week effects are presented in in Table 3. The outcome indicates that accounting for the separate effects of the social security weeks on the unexpected money supply is not statistically significant.^{25/} For each stock price index, SSUM does not achieve significance at any reasonable level. Only for SPUTIL does the interaction term come close to significance and here at only the 10 percent level. In general, therefore, it appears that we can reject the hypothesis that stock prices respond differently to unanticipated money when the latter comes from a social security week relative to all other observations.

The other hypothesis of interest concerns the generally assumed symmetrical influence of positive and negative unanticipated changes in money on stock prices.^{26/} To test this hypothesis, we again make use of zero-one dummy variables. Forming the appropriate interaction terms that orthogonalize positive and negative observations of UM, we can test for their difference.

Table 4 presents the results of this test. Positive values of UM are denoted UM (+); negative values by UM (-).^{27/} It is interesting to note that for the SP500, SP400 and the SPTRAN indexes, negative values of unexpected changes in money have no statistically significant affect on stock prices. In each case, the reported t-values are quite small, as are the estimated coefficients. Testing whether the coefficients on the

positive and negative values of UM differ, we find that for these three stock price measures the t-statistics are large enough to reject equality at the 5 percent level. Thus, it appears that only positive values of UM influence changes in these stock prices in a reliable manner. The results using the SPUTIL and SPFIN indexes, in contrast, indicate that positive and negative values of UM are not statistically different in their impact 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 evidence presented indicates that the occurrence of social security weeks apparently have no impact on reported results. We also have shown that previous research incorrectly attributes a symmetrical effect of positive and negative values of unexpected changes money on stock prices. Our evidence indicates that, except for the SPUTIL and SPTRAN measures, only positive values of unexpected money significantly influence the behavior of stock prices.

4. SUMMARY

The results of this study support the efficient markets hypothesis. Based on evidence from several different stock price indexes, only unanticipated money has a statistically significant impact on stock prices. Expected money was never significant at conventional levels. We also found that the estimated effect of unanticipated changes in money did not differ across alternative monetary policy regimes. Moreover, although no special effect was found when social security weeks were accounted for, we found that for the broad stock price indexes the effects of unanticipated money changes are asymmetric. In fact, we find

that for the SP500, SP400 and SPTRAN measures, only positive values of unanticipated changes in money have a significant impact.

The evidence presented also shows that the effects of discount rate changes tended to vary with the change in monetary policy procedures. In general, discount rate changes were most significant during the October 1979 to October 1982 period. Although insignificant after October 1982, we found that discount rate changes prior to October 1979 had a marginally significant positive effect on changes in stock prices. Also, the influence of discount rate changes tended toward insignificance as the stock index became more specialized.

FOOTNOTES

^{1/}The reader is referred to the surveys by Cornell (1983) and Sheehan (1985) and the references therein.

^{2/}Some alternative evidence is presented in Hein (1985), and Falk and Orazem (1985).

^{3/}We should point out that, although relatively little work has been done on 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).

Also, numerous studies 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." This partial collection of studies reflects the diversity of work done.

^{4/}A discussion of the October 1982 change in policy procedures is found in Wallich (1984) and Gilbert (1985).

^{5/}It is interesting that the Dow Jones Industrial Average (DJIA) is used often in empirical work, even though it is derived from a relatively small number (30) of component firms. Like any index number, this small number may place a large weight on any one stock. Consequently, a large "relative price movement" by one stock may mask a general decline in the others. For example, on September 24, 1985, the DJIA finished up 4.81 points. This increase, however, was due primarily to the 16-5/8 increase in General Foods, one of the components. Without this one stock, the DJIA would have registered about a 9 point decline.

^{6/}In his study, which I was made aware of only after the current study was completed, Hardouvelis (1985) also examines the impact of new information on several different stock price measures, including the Standard and Poor 500, the Standard and Poor 100, the New York Stock Exchange Composite Index, the New York Stock Exchange Financial Index, the Value Line Index and the AMEX Major Market Index.

^{7/}On these points, see Hafer (1984), Clark, et. al. (1985) and Schmidt and Haddad (1985).

^{8/}Cornell (1983), Pearce and Roley (1985) and Hardouvelis (1985) provide no evidence on this issue as it relates to stock price effects.

^{9/}A more detailed discussion is found in Sheehan (1985).

^{10/}See, among others, Schwert (1981), Fama and Schwert (1977) and Nelson (1976). Evidence from other countries is provided in Branch (1974) and Cohn and Lessard (1981).

Fama (1981) has argued that expected inflation in such studies actually serves as a proxy for expected real activity. His evidence suggests that real returns are independent of expected inflation once expected real activity is accounted for. 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).

^{11/}This often is referred to as the policy anticipation effect. See Roley and Troll (1983) and Roley and Walsh (1985) for a discussion of this effect on interest rate responses to unanticipated changes in money.

^{12/} 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.

^{13/} 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 below, footnote 21.

^{14/} 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.

^{15/} Studies by King (1966), Meyers (1973), Farrell (1974), Livingston (1977) and Epps (1979), among others, examine the grouping of individual stocks.

^{16/} In their study, Smirlock and Yawitz (1985) attempt to determine technical from non-technical changes in the discount rate. Generally, their evidence suggests that it is only the non-technical (i.e., unexpected) changes that influence asset yields and stock prices.

^{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 exact dates.

^{18/} Note that equation (1) is estimated without day-of-the-week variables. Previous analysis by Pearce and Roley (1985), using the same

data, find that the presence or absence of these variables did not influence their results. In fact, they report that only the Friday dummy had a significant coefficient and only for the pre-October 1979 period. Thus, given this evidence and the fact that we are using the same data, we also omit day-of-the-week variables. Other evidence, much of it conflicting, on the existence of day-of-the-week effects are reported in French (1980) and Gibbons and Hess (1981).

It also should be noted it was necessary to correct for serial correlation for the SPTRAN, SPUTIL and SPFIN indexes. Although we report the corrected results, the qualitative conclusions were not altered from the OLS results.

Finally, following Pearce and Roley (1985) and Hardouvelis (1985), 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 increase our understanding beyond that provided by Pearce and Roley, we do not report the results here.

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

^{20/} Testing the hypothesis that the estimated coefficient on the discount rate change is equal to unity results in the following t-statistics: SP500--0.16; SP400--0.07; SPTRAN--0.28; and SPFIN--0.10.

^{21/} Many studies using discount rate change data take the announcement day as the day it becomes "public." Depending on how one

times the publication of the new information may alter the results. For example, Smirlock and Yawitz (1985) state that "For the purposes of this study, the announcement day is the day the discount rate change was reported in the Wall Street Journal" (p. 1144, my emphasis). There are, however, 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 in the Wall Street Journal. Because of this, our study enters the discount rate change on the trading day when the change becomes effective.

To illustrate how sensitive the results are to this adjustment, the SP500 equation was re-estimated for the pre-October 1979 period using as the announcement day that day when the discount rate change appeared in the the Wall Street Journal. The resulting equation is (absolute value of t-statistics in parentheses):

$$\Delta SP500_t = 0.039 - 0.092 UM_t - 0.974 DR_t$$

(1.19) (2.04) (2.29)

$$R^2 = 0.17 \quad SE = 0.712 \quad DW = 1.67$$

Although DR remains significant, note that the estimated coefficient now indicates a negative response of stock prices, as others have found. Closer examining 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 reduce the possibility of future inflation. If we change only this one announcement day from the

day when it became effective (Friday) to the day when it appeared in the Wall Street Journal (Monday), the above estimate becomes

$$\Delta SP500_t = 0.04 - 0.098 UM_t - 0.872 DR_t$$

(1.14) (2.18) (2.05)

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

Thus, two points should be made. First, 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.

^{22/} The evidence in footnote 21 and accounts of discount rate changes in the Wall Street Journal does not support this view, however.

^{23/} 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 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 changes in policy objectives. Another case in point is the relative behavior of the federal funds rate and M1 relative to pre-stated policy objectives during 1985.

^{24/} Social security weeks occur when the third day of the month--the day when many social security checks are deposited by mail into recipient's transactions accounts--falls on a weekend, or on a holiday that also happens to be a Friday or a Monday. This calendar

quick artificially enlarges the actual change in M1 for that week, because these deposits are held on financial institutions' balance sheets as transactions accounts for an extra amount of time, relative to other weeks. During such weeks, the survey forecast, therefore, is for the actual change in M1 plus the amount induced by the calendar quick in the social security payments system.

25/ During our sample period, there were 32 social security weeks. We also tested for the possible effects stemming from benchmark and seasonal revisions in M1. These results indicated no separate, statistically significant effect.

26/ Little research into the symmetry 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. In terms of interest rate studies, Belongia and Kolb (1984) directly test for the effects of positive and negative unanticipated changes in M1.

27/ Values of zero are included in the UM (+) data.

Table 1
Estimates of Equation 1

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

Notes: Absolute value of t-statistics are reported in parentheses. 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 measure as first-differences of the logarithms of Standard and Poor's 500 (SP 500), 400 stock index (SP 400), the transportation index (SPTRAN), the utility index (SPUTIL) and the financial index (SPPIN). The right-hand-side measures are unexpected changes in M1 (UM) and expected changes in M1, based on the Money Market Services, Inc. survey. DR and DRS represent, respectively, the percentage change in the Federal Reserve's discount rate and surcharge rate. The terms D1, D2 and D3 represent (0, 1) dummy variables where D1 = 1 for the period September 23, 1977 through October 5, 1979, 0 elsewhere; D2 = 1 from October 5, 1979 through October 15, 1982, 0 elsewhere; and D3 = 1 for the period October 15, 1982 to December 31, 1984, 0 elsewhere.

Table 2
Hypothesis Test Results

<u>Hypothesis</u>	<u>Index/F-statistics^{1/}</u>				
	<u>SP500</u>	<u>SP400</u>	<u>SPTRAN</u>	<u>SPUTIL</u>	<u>SPFIN</u>
D1EM = D2EM = D3EM = 0	1.23 (0.30)	1.24 (0.29)	1.33 (0.26)	1.08 (0.36)	1.41 (0.24)
D1EM = D2EM = D3EM	0.19 (0.83)	0.17 (0.84)	1.20 (0.30)	0.16 (0.85)	0.46 (0.63)
D1UM = D2UM = D3UM = 0	8.04 (0.00)	7.31 (0.00)	3.40 (0.02)	17.81 (0.00)	8.96 (0.00)
D1UM = D2UM = D3UM	0.08 (0.92)	0.03 (0.97)	0.68 (0.51)	2.48 (0.08)	0.88 (0.42)
D1DR = D2DR = D3DR = 0	3.68 (0.01)	3.81 (0.01)	2.00 (0.11)	1.24 (0.29)	1.97 (0.11)
D1DR = D2DR = D3DR	5.15 (0.01)	5.47 (0.00)	2.97 (0.05)	1.03 (0.36)	2.78 (0.06)

Notes: Marginal significance levels reported in parentheses. Variable definitions are found in Table 1.

Table 3
Test Results for Social Security Week Effects

Variable	Index				
	SP500	SP400	SPTRAN	SPUTIL	SPFIN
Constant	0.031 (1.48)	0.032 (1.46)	0.040 (1.18)	0.016 (0.85)	0.026 (0.90)
UM	-0.108 (4.04)	-0.104 (3.76)	-0.095 (2.72)	-0.120 (6.84)	-0.124 (4.39)
SSUM	-0.017 (0.31)	-0.028 (0.47)	0.017 (0.23)	0.064 (1.74)	0.027 (0.46)
D1DR	0.944 (1.82)	1.066 (1.97)	1.214 (1.80)		0.967 (1.76)
D2DR	-0.600 (2.36)	-0.600 (2.27)	-0.342 (1.03)		-0.451 (1.68)
D3DR	1.214 (1.55)	1.322 (1.62)	1.408 (1.38)		0.381 (0.46)
DRS	-0.414 (2.56)	-0.403 (2.39)	-0.483 (2.29)	-0.577 (5.29)	-0.645 (3.76)
$\bar{R}^2$	0.020	0.018	0.011	0.039	0.024
SE	0.877	0.913	1.166	0.597	0.952
DW	1.79	1.82	2.00	1.99	2.01
ρ	---	---	0.19 (8.31)	0.26 (11.69)	0.23 (9.95)

Notes: SSUM represents an interaction term formed by multiplying UM by (0, 1), where SSUM = UM during social security weeks, zero elsewhere. Other definitions are found accompanying Table 1.

Table 4
Test Results for Symmetry

Variable	Index				
	SP500	SP400	SPTRAN	SPUTIL	SPFIN
Constant	0.048 (2.18)	0.049 (2.16)	0.067 (1.90)	0.024 (1.20)	0.040 (1.32)
UM(+)	-0.162 (5.07)	-0.164 (4.93)	-0.166 (4.01)	-0.120 (5.75)	-0.153 (4.56)
UM(-)	-0.046 (1.24)	-0.041 (1.08)	0.006 (0.13)	-0.086 (3.65)	-0.072 (1.89)
D1DR	0.937 (1.81)	1.059 (1.96)	1.195 (1.77)		0.955 (1.74)
D2DR	-0.604 (2.39)	-0.607 (2.30)	-0.340 (1.03)		-0.446 (1.66)
D3DR	1.232 (1.57)	1.341 (1.64)	1.432 (1.40)		0.394 (0.47)
DRS	-0.403 (2.49)	-0.391 (2.32)	-0.467 (2.21)	-0.551 (5.22)	-0.637 (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 (8.38)	0.27 (11.73)	0.23 (9.94)

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

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