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INFLATION AND RATES OF RETURN ON COMMON STOCKS

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1. INTRODUCTION

THERE WOULD SEEM to be little doubt that if one had surveyed academic and nonacademic students of the stock market in the year 1968 that one would have found wide agreement with the proposition that rates of return on common stocks move directly with the rate of inflation. This proposition simply extends Irving Fisher's well-known hypothesis [5] to rates of return on common stocks. That hypothesis states that *expected* rates of return consist of a "real" return plus the expected rate of inflation and the real return does not move systematically with the rate of inflation; in short, investors will on average be fully compensated for erosion in purchasing power. Belief in the extension of Fisher's Hypothesis to returns on stocks has suffered considerable erosion in recent years as a result of what appears to be dramatically contradictory evidence. The purpose of this paper is to investigate empirically the relation between returns on common stocks and the rate of inflation over the post-war period. The evidence presented does not support the Fisher hypothesis but rather suggests that a negative relation between returns and both *anticipated* rates of inflation and *unanticipated* changes in the rate of inflation has prevailed over the post-war period. Following up the implication of a negative relation with anticipated inflation, post-sample prediction tests for 1973 and the first half of 1974 indicate that past rates of inflation could have been used to pursue trading rules that generated higher returns than a buy-and-hold policy during that period.

2. THE FISHER HYPOTHESIS APPLIED TO COMMON STOCKS

The *ex ante* real rate of return on a portfolio of common stocks is *defined* as the difference between the expected return on that portfolio and the expected rate of inflation, hence

$$\alpha_t \equiv E(R_t|I_t) - E(\rho_t|I_t) \tag{1}$$

where α_t is the *ex ante* real rate, R_t is the realized rate of return the portfolio during period t, I_t is the information set available to the market at the beginning of period t, E is the mathematical expectations operator, and ρ_t is the rate of inflation

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realized over period t. Irving Fisher's hypothesis states that α_t, the *ex ante* real rate, is uncorrelated with the expected rate of inflation, so that on average investors are compensated for changes in purchasing power. Testing of Fisher's hypothesis must necessarily be based on observable variables, in particular on actual rates of return R_t and actual rates of inflation ρ_t which are linked to their *ex ante* counterparts by the relations

$$R_t = E(R_t | I_t) + u_t \tag{2}$$

$$\rho_t = E(\rho_t | I_t) + \epsilon_t \tag{3}$$

where u_t and ϵ_t are prediction errors which are uncorrelated with the predicted values. Separating the *ex ante* real return α_t into average and variable parts α and $\tilde{\alpha}_t$ and using (1), (2) and (3), we can express the relationship between observed stock returns and rates of inflation as

$$R_t = \alpha + \beta\rho_t + (\tilde{\alpha}_t + u_t - \beta\epsilon_t) \tag{4}$$

where β is unity under the Fisher hypothesis.

The properties of least squares estimates of α and β will depend on the properties of the compound disturbance term consisting of $\tilde{\alpha}_t$, u_t, and ϵ_t, in particular, on the correlation between ρ_t and each of these elements. Since ϵ_t is the market's error in predicting ρ_t, it will be positively correlated with ρ_t. Equivalently, ρ_t may be regarded as the market's forecast measured with error ϵ_t. Correlation between u_t, the unanticipated portion of the return on stocks, and ρ_t will depend on the correlation between u_t and ϵ_t. This correlation will not be zero if stock prices respond systematically to new information about the rate of inflation represented by ϵ_t. The proposition that stock prices will respond to new information about inflation is suggested by classical valuation theory if the firm has assets or liabilities denominated in nominal terms. This line of argument has received emphasis in papers by Kessel [7], Kessel and Alchian [8], Nichols [15], Lintner [9, 10], Bradford [3], and Nelson [13]. Van Horne and Glassmire [18] emphasize the effect of leads and lags in price-cost adjustments on present values. Finally, if stock returns are to adjust to the rate of inflation as the Fisher hypothesis requires, then $\tilde{\alpha}_t$ must be uncorrelated with ρ_t.

In view of the above it is easy to show that under the Fisher hypothesis the probability limit of the least squares estimator $\hat{\beta}$ is given by

$$\operatorname{plim}\hat{\beta} = \left[1 - \frac{v(\epsilon)}{v(\rho)} + \frac{C(\epsilon, u)}{v(\rho)}\right]. \tag{5}$$

The error in ρ_t as a measure of expected inflation will operate to attenuate the regression slope, but since $v(\epsilon) \leqslant v(\rho)$ (from (3)) this factor would not in itself be able to account for negative values of $\hat{\beta}$. In fact, evidence presented later in the paper would suggest that $v(\epsilon)/v(\rho)$ may be roughly .5, so on grounds of measurement error alone we might expect β to be roughly .5. However, if the market reacts negatively to unanticipated increases in the rate of inflation ($C(\epsilon, u) < 0$) then $\hat{\beta}$

would be attenuated further and could in fact be negative. Of course, a negative $\hat{\beta}$ could also result if the Fisher hypothesis does not hold but rather the *ex ante* return on stocks is negatively correlated with the expected rate of inflation. This ambiguity is eliminated if the contemporaneous rate of inflation is replaced by a past rate of inflation since past rates contain no new information for the market to react to, thus eliminating the third term in (5). In that case the value of plim $\hat{\beta}$ will depend on the strength of the correlation between the past rate of inflation and the expected rate of inflation at time t. Since that correlation should be positive in a highly autocorrelated series such as the rate of inflation, we would expect the regression coefficients for past rates of inflation to be positive under the Fisher hypothesis.

3. Regression Tests

To test these predictions of the Fisher hypothesis, monthly returns on a diversified portfolio of common stocks were regressed on monthly rates of inflation measured by the consumer price index. The monthly stock returns consist of the Scholes Index of value-weighted returns for the period January 1953 through December 1972 and returns on the Standard and Poor's 500 Index for January 1973 through June 1974. The Scholes Index is adjusted for dividends, the Standard and Poor's returns are not (except when used in post-sample prediction tests). Both indices measure returns to the end of the month from the end of the previous month. The CPI, on the other hand, does not purport to measure goods prices at any definite point in the month, but rather sampling of prices goes on throughout the month (see Shiskin [17]) and some prices for some locations are not measured each month but are interpolated. A number of questions can be raised about the suitability of the CPI for measuring ρ in Fisher's model. First of all, there is the usual set of questions about the design of any price index which claims to be representative. Those questions have been discussed at length elsewhere, and no attempt is made to review the relevant issues here. Another set of questions arises with regard to the timing of CPI measurements, their public announcement, and the actual rate of flow of information to the market. As mentioned above, the CPI is not an end-of-month index but various components are measured at different times during the month. Public announcement is not made until about the third week of the following month, although this announcement may in fact convey little or no incremental information to the market beyond that available in the meantime from other sources (such as direct observations by market participants). Nevertheless, these questions do suggest the possibility that if inflation is measured by the CPI then ρ_{t-1} and ρ_{t+1} in addition to ρ_t may convey some information which is in fact contemporaneous with R_t and which may be correlated with u_t.

Regressions of stock returns on individual leads and lags in the rate of inflation appear in Table 1 for the periods 6/53–7/71 (pre-price controls), 6/53–6/74, 6/53–12/63, and 1/64–6/74. Each entry in the table gives the β estimate, t-ratio, and correlation between the market return and the rate of inflation for the indicated *individual* lead or lag. Durbin-Watson statistics are not reported individually since they were consistently around 1.8 to 1.9 reflecting in part the small positive first order autocorrelation which is present in the Scholes Index (numeri-

TABLE I

REGRESSIONS OF MONTHLY MARKET RETURNS ON MONTHLY CHANGES IN THE LOG OF THE CPI (SLOPE ESTIMATE, t-RATIO, AND CORRELATION) FOR INDIVIDUAL LEADS AND LAGS

CPI Lead (+) or Lag (−)	June 1953–April 1971	June 1953–Feb. 1974	June 1953–Dec. 1963	Jan. 1964–Feb. 1974
+4	−1.14	−1.90	−2.64	−1.42
	(−.95)	(−2.22)	(−1.58)	(−1.14)
	−.06	−.14	−.14	−.10
+3	−2.76	−2.81	−3.17	−2.85
	(−2.31)	(−3.26)	(−1.91)	(−2.29)
	−.16	−.20	−.17	−.20
+2	−.95	−1.57	−.66	−1.67
	(−.79)	(−1.76)	(−.39)	(−1.29)
	−.05	−.11	−.03	−.12
+1	−3.88	−2.81	−5.57	−1.61
	(−3.29)	(−3.18)	(−3.45)	(−1.25)
	−.22	−.20	−.30	−.11
0	−2.48	−2.89	−.58	−4.22
	(−2.06)	(−3.19)	(−.34)	(−3.29)
	−.14	−.20	−.03	−.29
−1	−3.56	−2.82	−4.18	−2.10
	(−3.00)	(−3.00)	(−2.54)	(−1.50)
	−.20	−.19	−.22	−.14
−2	−.90	−1.39	−.31	−1.51
	(−.74)	(−1.44)	(−.18)	(−1.05)
	−.05	−.09	−.02	−.10
−3	−2.80	−3.68	−3.16	−4.35
	(−2.34)	(−3.89)	(−1.90)	(−3.14)
	−.16	−.24	−.17	−.28
−4	−1.88	−1.46	−1.68	−.81
	(−1.57)	(−1.49)	(−1.00)	(−.56)
	−.11	−.09	−.09	−.05

cally .11). The most striking features of these results is the uniformly negative and generally statistically strong correlation between rates of return and inflation. (The reader may wish to compare these regressions with ones presented by Lintner [9] for annual data over the period 1901–1971 which show rather similar results.) While negative correlation for contemporaneous or leading rates of inflation could perhaps be reconciled with the Fisher hypothesis if the market reacts strongly and negatively to unanticipated increases in the rate of inflation (reflected in the term

$C(\epsilon, u)$ in (5)), the negative lagging correlation are much more difficult to reconcile with the Fisher hypothesis since past rates of inflation contain no surprises.

The regression results could conceivably be more favorable to the Fisher hypothesis if we could use a better proxy for anticipated inflation than just the observed rate. It is reasonable to suppose that much of the information about future inflation rates available to the market is contained in past rates of inflation. It would seem worthwhile, therefore, to consider multiple regressions of stock returns on current and past inflation rates. As we shall see later, the autocorrelation structure of the CPI data is such that an extrapolative predictor of inflation would place positive weights on past inflation rates. Regressions for lags zero through four months are presented in Table 2 for sample periods corresponding to Table 2. These results are also very difficult to reconcile with the view that stocks are a

TABLE 2

REGRESSIONS OF MONTHLY MARKET RETURNS ON CONTEMPORANEOUS AND LAGGED CHANGES IN THE LOG OF THE CPI

Lag	June 1953– April 1971	June 1953– Feb. 1974	June 1953– Dec. 1963	Jan. 1964– Feb. 1974
0	−1.40	−1.94	.05	−3.46
	(−.99)	(−1.75)	(.03)	(−2.27)
1	−2.83	−1.56	−3.80	−.04
	(−1.97)	(−1.02)	(−2.17)	(−.03)
2	1.85	.95	1.00	.64
	(1.25)	(.80)	(.56)	(.39)
3	−1.56	−2.79	−2.08	−3.24
	(−1.09)	(−2.42)	(−1.19)	(−1.99)
4	−.64	.46	−1.61	.99
	(−.46)	(.40)	(−.92)	(.62)
Sum of Coefficients	−4.59	−4.46	−6.44	−5.11
(t for sum)	(−2.79)	(−3.53)	(−2.22)	(−2.63)
Constant	.02	.02	.02	.02
	(4.89)	(5.27)	(4.26)	(3.22)
Durbin-Watson	1.81	1.86	1.85	1.81
R^2	.06	.08	.07	.12
F	2.47*	4.02**	1.81	3.10*
F on Lags Only	2.00	2.41*	2.23	1.15

* F significant at .05 level.

** F significant at .01 level.

hedge against inflation. Coefficients are predominantly negative, particularly at lags 0, 1, and 3 months. The overall significance of the regressions is greatest for those which include the post-1971 (price-controls) period in spite of the fact that this was a period of suppressed inflation and low returns on stocks. The sum of regression coefficients is negative, large and highly significant in each subperiod. Perhaps surprisingly, the sum of coefficients is largest for the 1953–1963 subperiod. The most conspicuous difference between the 1953–1963 and 1964–1974 subperiod regressions is the shift in weight from the one month lag coefficient in the earlier subperiod to the contemporaneous coefficient in the later subperiod. The differences are not, however, statistically significant since the F for testing stability of the underlying relationship is only 1.097 (6 and 237 *df*) which is close to its expected value under the null hypothesis.

Information available to the market about future rates of inflation may well exceed that contained in just the past history of inflation rates. If this is the case then we might expect future actual rates of inflation to enter a regression that also includes past rates of inflation. To investigate this possibility two-sided lag regressions were run for leads and lags of $+4$ to -4 months; the results appear in Table 3. It is apparent that the lead coefficients are relatively unimportant with the possible exception of $+1$ month. The latter may be due in part to the previously mentioned fact that in effect two weeks of the CPI month have elapsed when the market closes at the end of the calendar month. The sums of coefficients are again large, negative, and highly significant and are little changed from the Table 2 regressions except that the sum is larger in absolute value for the 6/53–12/63 subperiod. Oddly enough, the subperiod with the lowest F significance level is the 1/64–2/74 subperiod, the one which in most people's minds would, I think, be associated with accelerating inflation and declining returns on common stocks.

4. Market Return and "Unanticipated" Changes in the Rate of Inflation

The adjustment of the market to changes in the anticipated rate of inflation would be much easier to trace if actual changes in rates of inflation could be decomposed into anticipated and unanticipated components. While a full decomposition is infeasible without access to all information available to the market, it is feasible to isolate that portion of any change which could not be predicted (linearly) from past rates of inflation. To carry out the latter kind of decomposition we need only obtain an appropriate repressntation of the inflation series as a discrete linear stochastic process. Such a representation is presumably more meaningful for the period prior to price controls (January 1953–August 1971) since under controls the autocorrelation structure of the inflation series may have changed and many large changes in the rates of inflation could be anticipated to a considerable extent from changes in control regulations, for example, the surge in prices in August 1973 following decontrol of a number of important commodities. Applying the procedures developed by Box and Jenkins [2] to the CPI monthly data the following model emerged as a satisfactory representation

$$\rho_t = \rho_{t-1} + v_t - .86v_{t-1} \tag{9}$$

TABLE 3

REGRESSIONS OF MONTHLY MARKET RETURNS ON FUTURE CONTEMPORANEOUS, AND LAGGED CHANGES IN THE LOG OF THE CPI

Lead or Lag	June 1953–April 1971	June 1953–Feb. 1974	June 1953–Dec. 1963	Jan. 1964–Feb. 1974
+4	.94 (.63)	.19 (.16)	−2.24 (−1.28)	.81 (.47)
+3	−1.50 (−1.00)	−1.21 (−1.02)	−1.22 (−.70)	−.73 (−.42)
+2	1.72 (1.13)	1.28 (1.06)	.86 (.48)	1.08 (.61)
+1	−2.51 (−1.65)	−1.36 (−1.15)	−4.59 (−2.53)	−.09 (−.05)
0	−1.49 (−.97)	−1.93 (−1.65)	.61 (.34)	−3.61 (−2.21)
−1	−2.19 (−1.44)	−.79 (−.65)	−2.18 (−1.20)	−.43 (−.25)
−2	1.79 (1.17)	1.24 (.99)	.61 (.34)	.55 (.30)
−3	−1.48 (−.99)	−2.68 (−2.15)	−1.33 (−.75)	−3.44 (−1.84)
−4	−.27 (−.18)	.72 (.58)	−.55 (−.32)	.77 (.41)
Sum of coefficients (t for sum)	−4.93 (−2.86)	−4.53 (−3.57)	−10.03 (−3.09)	−5.09 (−2.58)
Constant	.02 (4.90)	.02 (5.31)	.02 (4.89)	.02 (3.10)
Durbin-Watson	1.76	1.84	1.87	1.80
R^2	.0817	.0914	.1362	.1255
F	2.03*	2.67**	2.05*	1.79
F (leads only)	1.44	.99	2.26	.25
F (leads and lags)	1.73	1.70	2.29*	.68
F (lags only)	1.17	1.85	.64	1.10

* F significant at .05 level.
** F significant at .01 level.

where v_t denotes a sequence of uncorrelated random disturbances with mean zero and estimated standard deviation .0017. The v_t can be interpreted as the change in ρ_t which cannot be predicted from past history. To see this, note the process may be rewritten in the forms

$$\rho_t = .14 \sum_{i=1}^{\infty} (.86)^{i-1} \rho_{t-i} + v_t$$

$$= .14 \sum_{i=1}^{\infty} v_{t-i} + v_t$$

$$= \hat{\rho}_t + v_t \tag{10}$$

where $\hat{\rho}_t$ is the conditional expectation of ρ_t given past data. Since v_t is the unanticipated portion of ρ_t it will trigger a revision of expectations; thus from (10)

$$\hat{\rho}_{t+1} = .14 \sum_{i=0}^{\infty} v_{t-i}$$

$$= \hat{\rho}_t + .14 v_t. \tag{11}$$

If the information available to the market exceeds that contained simply in past inflation rates, then the market may be able in part to anticipate future values of v. All past v's, however, will be reflected in a rational expectation of inflation. The rational forecast $E(\rho_t | I_t)$ can be expressed as

$$E(\rho_t | I_t) = \hat{\rho}_t + w_t \tag{12}$$

where w_t results from the additional information known to the market and will be uncorrelated with $\hat{\rho}_t$ [12]. This implies that if we regress the return as stocks on the elements of $\hat{\rho}$, the v's, then under the Fisher hypothesis we should recover the *positive* weight given to *past* v's in the expression for $\hat{\rho}$ and either positive or negative coefficients for the contemporaneous and future v's depending on whether the market reacts positively or negatively with regard to *changes* in the anticipated rate of inflation [16, 14].

It may be worth noting at this point that it is not at all necessary to establish a negative correlation between stock returns and past v's to cast doubt on the Fisher hypothesis. Rather, all that is required is the lack of a positive relationship.

A small improvement on the simple model in terms of standard error is obtained by including additional moving average coefficients at the seasonal lags 12, 24, and 36. While these seasonal parameters are statistically significant and therefore are included in the model used subsequently, they do not materially alter the simple picture of the forecasting function given by (10). Residuals from that model are estimates of the v's over the sample period. Regressions of R on individual leads and lags in sample period estimates of the v_t as well as multiple regressions for lags only and leads and lags together over the 1953–1971 period are given in Table 4.

Since the v_t are essentially uncorrelated over time, the multiple regressions are very nearly orthogonal regressions. These regressions again reflect the pre-

TABLE 4

Regressions of Monthly Market Returns on "Unanticipated" Changes in the Change in the Log of the CPI, September 1953–April 1971

Lead or Lag	Individual Leads and Lags	Multiple Regressions: Lags Only	Multiple Regressions: Leads and Lags
+4	.51 (.29) .02		.66 (.38)
+3	−2.34 (−1.34) −.09		−1.64 (−.95)
+2	3.29 (1.90) .13		3.42 (1.99)
+1	−4.02 (−2.33) −.16		−3.40 (−1.97)
0	−2.46 (−1.42) −.10	−2.72 (−1.57)	−3.32 (−1.92)
−1	−3.38 (−1.95) −.13	−3.65 (−2.11)	−3.06 (−1.76)
−2	−.23 (−.13) −.01	−.47 (−.27)	−.62 (−.36)
−3	−2.67 (−1.53) −.10	−3.07 (−1.76)	−3.46 (−2.00)
−4	−2.92 (−1.68) −.11	−3.57 (−2.06)	−3.51 (−2.04)
−5	−2.53 (−1.45) −.10	−2.56 (−1.47)	−2.28 (−1.31)
−6	−2.61 (−1.50) −.10	−2.44 (−1.41)	−2.51 (−1.45)
Constant		.01 (3.87)	.01 (3.84)

TABLE 4 (*Continued*)

Lead or Lag	Individual Leads and Lags	Multiple Regressions: Lags Only	Multiple Regressions: Leads and Lags
Durbin-Watson		1.89	1.81
R^2		.0788	.1240
F		2.49*	2.57**
F (lags only)		2.56*	2.97**
F (leads only)			2.26
F (leads and lags)			2.97**

* F significant at .05 level.

** F significant at .01 level.

dominantly negative impact of inflation on market returns and suggest that, contrary to the Fisher hypothesis, returns continue to reflect shifts in the anticipated rate of inflation months after they have occurred. There is also some suggestion from the lead coefficients that the market may be able to anticipate at least partially future changes not predictable from past rates of inflation, although again this may largely reflect the overlapping of measurement intervals.

It is difficult indeed to see how these results can be reconciled with the Fisher hypothesis which would have predicted positive coefficients at least on lagged values of v. The results *are* consistent with the hypothesis that the market responds inversely to contemporaneous shifts in expectations of inflation. However, it would seem that the negative coefficients on lagged v's can only be explained either by lags in the adjustment of the market to new information, which seems implausible, or by a negative relationship between anticipated rates of inflation and *ex ante* rates of return. Lintner [10] has recently argued that the latter can be explained by greater relative dependence of the firm on external financing in periods of higher inflation rates.

6. Post-Sample Prediction Tests

The foregoing evidence would seem to suggest that *ex ante* as well as *ex post* returns on stocks are correlated with current and past rates of change in the CPI. If this hypothesis is correct, then it should be possible to use information from the CPI series to predict future rates of return on stocks. The prediction experiments described in this section make use of three regression equations each estimated using data for the period January 1953–December 1972. The regressions reflect a range of assumptions about the information avialable to the market. The regression which assumes the most information (Regression I) corresponds to those reported in Table 2 using the contemporaneous rate of inflation as well as rates lagged through four months. Since the CPI is measured through the month using this regression for prediction would require roughly two weeks of foresight on the part of the market. A second regression (II) uses lags one through four months. This assumes that the change in the CPI for the month is known to the market by month-end. The third (III) regression uses only lags two through four allowing for the possibility that the actual CPI is unknown until the time of the public announcement, usually in the third week of the following month. The post-sample period is January 1973 through June 1974. Reported rates of inflation as measures of actual rates may have been substantially poorer than usual during this period if price controls and subsequent decontrol had the effect of masking "real" price changes. Some CPI changes during this period would also have been more predictable than usual, in particular the strong surge in prices in August 1973, and are unlikely to have had a material impact on expectations. This jump in the CPI will nevertheless be reflected in the regression predictions for later months. Since the Scholes Index ends at present in December 1972, returns for the post-sample period are returns in the Standard and Poor's 500 Index including dividends.[1]

The null hypothesis underlying the first prediction test is the random walk hypothesis. In particular we consider the hypothesis that monthly market returns are random drawings from a symmetric distribution with a constant mean of .0101, the actual sample mean for 1953–1972. If the null hypothesis is true, then a regression prediction will have only a 50 percent chance of picking the correct sign of $(R-\bar{R})$. For the eighteen post-sample months, the number of "successes" were 14, 14, and 13 for regressions I, II and III respectively. Corresponding significance levels under the null hypothesis are .0154, .0154, and .0327. It would appear then that all of the regressions were able during this period to predict direction more accurately than pure chance would allow.

The second set of prediction tests involve several investment strategies using the three regression predictions. The results are summarized in Table 5. The first strategy involves purchasing the index when predicted return is positive and holding cash when predicted return is negative. The three regressions produce average monthly returns of −.08, −.26 and −.48 percent, respectively, compared

TABLE 5

AVERAGE MONTHLY RATES OF RETURN ON TRADING STRATEGIES FOR THE PERIOD JANUARY 1973–JUNE 1974

Strategy	Predictive Regression		
	I (Lags 0–4)	II (Lags 1–4)	III (Lags 2–4)
Buy and Hold	−.0141	−.0141	−.0141
Stocks or Cash	−.0008	−.0026	−.0048
Stocks or Commercial Paper	+.0058	+.0058	+.0033
Buy or Sell Short	+.0126	+.0088	+.0045

1. I am grateful to Myron Scholes for providing me with the Standard and Poor's dividend adjustments as well as yields on commerical paper also used in this section.

with a buy-and-hold monthly return for the period of -1.41 percent. Regression I calls for holding stocks only in January and October 1973, regression II adds August 1973, and regression III adds February, March, and April 1973 but not August. The second strategy involves comparing predicted return with the one month return on commerical paper and choosing stocks or paper accordingly. The average monthly returns are +.0058, +.0058, and +.0033 respectively. Regressions I and II call for holding stocks only in January and October 1973 while III adds February and March 1973. The average return on commerical paper over the period was .0072. The third strategy is a long or short sale strategy based on the sign of predicted return. The average actual returns on this strategy were +.0126, +.0088, and +.0045, which are the highest returns obtained on all of the regressions. The reader is cautioned, however, that no adjustment has been made for transaction costs, a factor which may be of material importance particularly in short sales.

7. Predictive Regressions and Market Efficiency

The concept of rational or "efficient" markets [11, 4] holds that valuable information will not be wasted but rather will be reflected in market prices. That *ex ante* rates of return are not constant through time or that they are correlated with *ex ante* observable economic variables, or even that they are negatively correlated with the expected rate of inflation, is in no way inconsistent with the efficiency hypothesis *per se*. It follows that market efficiency is not itself a testable hypothesis, but can only be tested jointly with a particular hypothesis about the behavior of expected returns. What is puzzling about the results reported in this paper is the implication that *ex ante* rates of return on stock may at certain times have been below risk-free yields or, even worse, negative. The first possibility is strongly at variance with modern capital market theory, the second with economic theory generally to say nothing of common sense. If these possibilities are ruled out, then some at least temporary departures from efficiency would seem to be implied. While chance, however small, can never be ruled out as the explanation for these results, a really satisfacory explanation is not at all apparent.

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DISCUSSION

DONALD A. NICHOLS*: The three papers in this session tell much the same story. The rate of return on common stocks is negatively correlated with the rate of inflation over short periods of time. This is surprising at first blush since common stocks represent, in part, a claim to real resources, and the value of these resources should increase with inflation.

I will argue, however, that these results are perfectly consistent with commonly held views and theories about asset pricing, and that the results should not be used to advise investors to shun stocks when they forecast a high rate of inflation.

1. A common stock can be thought of as a claim to present and future goods, and to present and future money. For a corporation that is a net debtor, the claim to future money is negative. When the expected rate of inflation changes, let us assume that there will be no change in the present value of future goods or of present goods and money in the instant that the forecast changes. It is only the value of future money which is changed.[1] To the extent that a common stock represents claims to future money, its value should change when the forecast rate of inflation changes.

It was once widely believed that corporations held, on balance, negative claims to future money. This is not the case, for corporations as a whole, however, even when one considers the recent large increases in corporate debt. Assets which have not been fully depreciated for tax purposes represent positive claims to future money (in the form of lower taxes), and the lag between payments to inputs and

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1. This use of the ceteris paribus assumption prohibits any adjustment on the part of individuals or firms to the new inflationary forecast.