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The Impact of Real Factors and Inflation on the Performance of the U.S. Stock Market From 1960 to 1980

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I. Introduction

AT ONE TIME it was widely believed that whatever growth in corporate earnings and market value took place without inflation—due to real factors such as profitability and reinvestment of earnings—would be augmented by the rate of inflation. This view has been shaken by the finding that the stock market moves inversely with the inflation rate in the short run[1] and by the generally poor performance of the market since 1967—a time of considerable inflation.

Lintner [1975], Modigliani and Cohn [1979], Feldstein [1980], and others have argued that accounting practice, the tax system, and investor behavior make the stock market respond negatively to inflation. While Feldstein acknowledged that the underlying profitability (earnings before interest and taxes) of U.S. corporations may have been depressed by foreign competition and a decline in productivity growth since 1967, he went on to argue that even if that did not take place, "an important adverse effect of increased inflation on share prices results from basic features of U.S. tax laws, particularly historic cost depreciation and the taxation of nominal capital gains." (p. 839) However, his paper did not go beyond the theoretical consequences of inflation and the tax system for the stock market's performance. Furthermore, a limitation of Feldstein's model, which he acknowledged, for explaining the value of shares is his assumption that corporations have no debt in their capital structures and pay out all earnings in dividends.

Modigliani and Cohn (M-C for short) claimed that the decline in the market value of common stocks since 1967 took place because inflation led investors to commit two errors in valuing shares. First, investors do not recognize—and corporations do not report—a major component of nominal earnings; that is, the increase in debt that corresponds to the rise in the nominal value of assets with inflation represents earnings that can be paid in dividends without raising the corporation's debt-to-equity ratio. Secondly, and quantitatively more important, investors do not recognize the expected rate of growth in nominal earnings due to inflation. However, the empirical work that persuaded M-C that investors actually make these errors in valuing shares does not convince this writer that certain other explanations for the stock market's performance in recent years can be dismissed.

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[1] The absence of a positive correlation between inflation and a share's holding period return has been found by Lintner, Nelson, Bodie, Friend and Hasbrouck, and others.

Holland and Myers [1979] examined the pre-tax and the post-tax profitability of corporations, and their data suggest that both have declined materially since the mid-sixties. Friend and Hasbrouck (F-H) [1981] carried out extensive regression analyses on time series data for a sample of firms to estimate the association between inflation and earnings and between inflation and a share's holding period return. They found that earnings are depressed and that the required holding period return is raised by inflation, the latter because the variability or risk of holding period returns increases with inflation. It follows from the above that the stock market should move inversely with inflation. However, the method of analysis used by F-H only allowed a rough estimate of the influence of earnings and of risk, and it did not allow them to estimate the contribution of other variables to the market's aggregate performance over the postwar years.

The purpose of this paper is to explain the impact of real factors and inflation on the performance of the U.S. stock market over the years 1960 to 1980. First, a general model of share valuation under inflation will be developed, one that recognizes the presence of debt, retention, personal and corporate taxes, and the tax and information consequences of inflation. Secondly, the model will be used to evaluate the influence on share value of plausible values for (1) the tax consequences of inflation, (2) the misinformation consequences of inflation, (3) changes in profitability, and (4) changes in the yield investors require on shares. Finally, the model will be employed to explain the actual change in the ratio of market value to replacement cost, q, for the common equity of the domestic operations of all nonfinancial corporations over the twenty years.

Our findings may be summarized as follows. First, although inflation increases the tax burden on corporations, that only explains—in theory and in fact—a negligible fraction of the decline in the value of q. Secondly, if nothing else changed over the period 1960 to 1980 but the inflation rate, the two errors in valuing shares that M-C attributed to investors would account for an even larger fall in q than actually took place. Finally, our data showed that q fell between 1960 and 1980 because corporate profitability declined and because a rise took place in the yield (gross of the personal income tax and net of the inflation rate) that investors require on shares.

One possible explanation for the rise in the required yield is that advanced by Feldstein—inflation and the capital gains tax combined to reduce the after-tax return on shares, while the required return remained unchanged. However, various other reasons appear to be no less reasonable, including the F-H finding that risk increases with inflation. Of course, whether the causality went from inflation to both profitability and required yield, or vice versa, or whether there was no causal relationship among these variables, is not determined by the data.

II. Theory

The value of a firm's share of stock may be represented as the expected value of the sum of the share's dividend for a period and its price one period hence, discounted to the sum's present value at the yield investors require on the share.

Accordingly,

$$q = \frac{(1-\theta)(1-b)y + q[1+(1-c)g]}{1+\kappa}$$

$$= \frac{(1-\theta)(1-b)y}{\kappa-(1-c)g}, \tag{1}$$

where:

q = the ratio of the market value of equity to its replacement cost;
y = the expected after-tax return on equity (i.e., the ratio of earnings on equity—net of corporate tax—to the equity, with both earnings and equity measured on a replacement cost basis);
g = the expected rate of growth in the market value of equity;
b = the fraction of earnings on equity expected to be retained;
θ = the tax rate on ordinary personal income, which varies among persons;
c = the tax rate on capital gains; and
κ = the yield at which a share sells based on its end-of-period payoff—net of personal taxes.

Eq. (1) only provides the after-tax dividend on a share for a person subject to a particular tax rate. Our use of Eq. (1) to represent the value of q prevailing in the market place assumes that there is no serious error in using an average θ over all investors to arrive at the after-tax dividend on a share. Eq. (1) also implies the existence of an average yield on a share net of the personal income tax. Finally, Eq. (1) is assumed to hold for all shares in aggregate as well as for each share.

To recognize the ways in which inflation may influence the expected after-tax return on equity, the latter may be written:

$$y = (1-\tau)[x(1+\eta) - m\eta - \lambda\pi + \eta\pi, \tag{2}$$

where:

τ = the tax rate on corporate profits;
x = the expected pre-tax return on assets (i.e., the ratio of earnings—before interest and taxes—to assets, with both earnings and assets measured on a replacement cost basis);
η = the debt-equity ratio with both debt and equity measured on a replacement cost basis;
m = the interest rate based on the imbedded or actual interest bill on outstanding debt;
π = the expected rate of inflation;
λ = the reduction in the after-tax return on equity resulting from the overstatement of taxable earnings when historical cost accounting is used and when the inflation rate is one per cent.

Other variables to be introduced later on are the following:

k = the yield at which a share sells based on its end-of-period payoff—gross of personal taxes;
d = the expected dividend rate (i.e., the dividend divided by the equity);
r = the expected rate of return on equity investment;

i = the nominal or current interest rate on debt; and
ρ = the value of κ when $\eta = 0$.
Finally, a bar under a variable (e.g., $\underline{k}$) is the value it would have in the absence of inflation.

In Eq. (2), $x(1 + \eta) - m\eta$ is simply the pre-tax return on equity—net of the *actual* interest bill—that a corporation would report when replacement cost is its basis of measurement. The reduction in the after-tax return on equity due to the use of historical cost accounting for tax purposes is $\lambda\pi$. The unreported earnings that Modigliani and Cohn claimed go unrecognized are $\eta\pi$. To elaborate, with inflation at the rate π and with η the debt-equity ratio, a firm's assets grow at the rate π due to inflation, and it can borrow $\eta\pi$ and pay a dividend of y (including $\eta\pi$) without raising its debt-equity ratio. It may be noted that the debt-equity ratio used in our model is at replacement cost and that the market-value ratio may be different. Regardless, their relation is constant over time if the values of x, τ, i, and η do not change over time. Furthermore, insofar as the market-value ratio enters into the determination of q, our model recognizes it.

The expected rate of growth in the market value of equity cannot be measured directly, but Gordon and Gould [1978] have shown that a reasonable estimate is $g = br$, which with inflation becomes

$$\begin{aligned} g &= br + \pi \\ &= b\{(1 - \tau)[x(1 + \eta) - i\eta] - \lambda\pi + \eta\pi\} + \pi. \end{aligned} \tag{3}$$

Here, br is the expected growth due to retention, and π is the expected growth due to inflation. Parenthetically, it may be noted that y, the return on equity of Eq. (2), and the return on equity investment—r in Eq. (3)—differ in their interest rates, m and i, respectively.

Substituting Eqs. (2) and (3) for y and g, respectively, in Eq. (1) results in a precise statement of our valuation equation:

$$q = \frac{(1 - \theta)(1 - b)\{(1 - \tau)[x(1 + \eta) - m\eta] - \lambda\pi + \eta\pi\}}{\kappa - (1 - c)b\{(1 - \tau)[x(1 + \eta) - i\eta] - \lambda\pi + \eta\pi\} - (1 - c)\pi}. \tag{4}$$

Rearranging Eq. (1) provides an expression for the yield at which the share represented by the equation is trading:

$$\kappa = \frac{(1 - \theta)(1 - b)y}{q} + (1 - c)(br + \pi), \tag{5}$$

where $(1 - b)y$ is the dividend divided by the replacement cost of the equity and br and π are the expected growth due, respectively, to retention of earnings and to inflation.[2] Insofar as $g = br + \pi$ is in error as an estimate of the expected rate of growth in share price, Eq. (5) is in error as an estimate of κ. Quite often the problem of estimating g is avoided by setting $b = 0$, and by replacing κ with $\underline{\kappa} =$

[2] It should be noted that earnings, or return on equity, was defined to exclude the growth in the equity due to inflation. With this exclusion and will all earnings paid in dividends, both earnings and equity are expected to grow at the inflation rate. Eq. (4) recognizes this expectation by including inflation growth in the denominator.

$\kappa - \pi$. However, these practices do not solve the problem, and the resulting value of $\underline{\kappa}$ is subject to error no less, and perhaps more, than the value of κ in Eq. (5).

It is of interest to consider what happens to q as a consequence of inflation under the Feldstein and the M-C theories. In the Feldstein model, using our notation, $b = \eta = 0$, and $\kappa = (1 - \theta)i + \delta$, where $i = \underline{i} + \pi$ and δ is a risk premium that is independent of both θ and π. Under these assumptions our Eq. (4) reduces to his Eq. (4) and becomes

$$q = \frac{(1 - \theta)[(1 - \tau)x - \lambda\pi]}{(1 - \theta)(\underline{i} + \pi) + \delta - (1 - c)\pi}. \tag{6}$$

Differentiating q with respect to π results in

$$\frac{\partial q}{\partial \pi} = \frac{-(1 - \theta)\lambda + q(\theta - c)}{(1 - \theta)(\underline{i} + \pi) + \delta - (1 - c)\pi}. \tag{7}$$

The first term in the numerator of Eq. (7) represents the negative consequences of using historical cost accounting for tax purposes, while the second term combines the negative consequences of the taxation of nominal capital gains due to inflation and the positive impact on q of Feldstein's assumption about how κ varies with inflation.[3]

To understand the quantitative implications of the Feldstein model, let $\lambda = .3$, $\theta = .3$, and $c = .15$, his values for these variables. If $\pi = 0$ and if we assign reasonable values of .4 and .10 to τ and x, respectively, then $q = 1$ when $\kappa = .042$. This value for κ is satisfied when $\theta = .3$ and $\pi = 0$ by having $\underline{i} = .035$ and $\delta = .0175$. Also $\kappa = .042$ implies that $k = .06$. An inflation rate of $\pi = .07$ would raise κ to .091, and with the rise in κ less than the rise in π, q would fall only slightly to .867. However, as will be shown later, between 1960 and 1980 the value of q for the domestic operations of all nonfinancial corporations actually fell from .897 to .556. Therefore, we conclude that the tax consequences of inflation under the Feldstein model of share valuation can explain only a very small fraction of the actual fall in q.

However, even this small reduction in q does not occur when Feldstein's model is enlarged to include retention and leverage. With reasonable values of $b = .4$ and $\eta = .3$, and with the values assigned above to the other variables, Eq. (5) reveals that $\kappa = .0545$ when $q = 1$ and $\pi = 0$. The rise in κ from .042 to .0545 is due to the income gain from leverage and the tax gains from leverage and retention under the constraint that $q = 1$. The rise in κ is reconciled with the Feldstein expression for κ when $\underline{i} = .035$ by having the combined risk of $\eta = .3$ and $b = .4$ raise δ to .03. When the inflation rate is raised to .07, we find that κ rises by less than .07; it only rises to .0135, and using Eq. (4) we find $q = 1.038$. Thus we see that under this extension of the Feldstein model the combined tax and yield consequences of inflation raise q instead of reducing it to .867.

Turning now to the M-C theory (and again using our notation), their model of

[3] Feldstein assumed that $\underline{i}$ is independent of π, implying that $(1 - \theta)i$, the real post-tax interest rate, falls as π increases. His expression for κ carries the further implication that $\delta\kappa/\delta\pi < 1$, so that $\underline{\kappa}$, the real post-tax share yield, falls as π increases. Hence, with $c = \lambda = 0$, inflation would raise q in Feldstein's model.

share valuation may be obtained from our Eq. (4) by assuming $b = \lambda = \theta = c = 0$, $m = i$, and $\kappa = \rho + (1 - \tau)(\rho - i)\eta/q$.[4] Under these assumptions our Eq. (4) reduces to their Eq. (18) and becomes

$$q = \frac{(1 - \tau)[x + (x - i)\eta] + \eta\pi}{\rho + (1 - \tau)(\rho - i)(\eta/q) - \pi}$$

$$= \frac{(1 - \tau)[x + (x - \rho)\eta] + \eta\pi}{\rho - \pi}. \tag{8}$$

The M-C hypothesis on the errors investors make in valuing shares is recognized by deleting $\eta\pi$ from the numerator and π from the denominator of the above expression.

The quantitative implications of the M-C hypothesis may be judged by first solving Eq. (8) for ρ when $q = 1$ and $\pi = 0$, and when reasonable values are assigned to the other variables, i.e., $x = .10$, $\tau = .4$, and $\eta = .3$. We find then that $\rho = .0661$, up from the .06 when $\pi = 0$, since the tax advantage of leverage raises ρ under the $q = 1$ constraint. Next, when we raise π to .07, ρ rises to .1361, and solving Eq. (8) for q results in $q = 1.127$. However, the investor errors of deleting $\eta\pi$ and π from the equation results in lowering q to .655. Enlarging the M-C model to include retention at the rate $b = .3$ and continuing all other assumptions (including the errors that investors are claimed to make in arriving at q), makes q fall to .266. Furthermore, recognizing that λ, θ, and c are not equal to zero produces various other values for q, depending on one's assumptions regarding the change in κ as π rises. In conclusion, it is clear that if true, the M-C hypothesis regarding investor errors could explain a large fall in q as π rises.

Finally, we may consider the quantitative impact on q of both a fall in profitability and a rise in required yield. Assume that in conjunction with a rise in π to .07, x falls from .10 to .07 and κ rises from .0545 to .1035, in accordance with Feldstein's model. Then q would fall to .468, and the above fall in profitability could explain the market's performance. To evaluate the quantitative implication of the Friend-Hasbrouck argument that inflation raises the risk premium on shares, we may raise κ to .1345 when $\pi = .07$, instead of the above .0135. The result is a fall in q from 1.0 to .452.

III. Data

The values of q and of all the variables on the right-hand side of Eq. (4)—except κ and the personal tax rates—can be estimated for the domestic operations of all nonfinancial U.S. corporations directly from data provided by the Department of Commerce and the Federal Reserve Board. This data is presented in Table 1 and is used below to estimate $\underline{k}$, the deflated yield on shares (gross of personal taxes), and, more important, to explain the rise in q during the sixties and its sharp decline during the seventies. The three years 1960, 1967 and 1980 capture

[4] In their theoretical model M-C ignored the corporate as well as the personal income tax. However, since their empirical work was based on equity earnings net of the corporate tax, we may presume that they would accept this equation, since it is really the Modigliani-Miller expression for share yield under a corporate income tax.

the essence of this problem: q was .897 in 1960, it had peaked at 1.215 in 1967, and it had fallen to .556 in 1980. Confining our analysis to these years avoids being buried in a mass of data for all the years between 1960 and 1980. Table 1 does also present data for 1978, the year in which q hit a low, but no reference is made in the discussion below to that data.

Turning to x, the expected pre-tax return on assets, our estimate rose from .0924 in 1960 to .1170 in 1967 and then fell to .0717 in 1980. Thus we see that the underlying profitability of the corporate sector fell sharply between 1967 and 1980 to a level well below the 1960 figure. The expected after-tax return on equity that M-C claim investors incorrectly take as y is $y(1)$, which excludes any adjustment for the depreciation in the value of debt caused by inflation. Table 1 shows $y(1)$ rising sharply from .0525 to .0848 between 1960 and 1967 and then falling even more sharply to .0325 in 1980.

The greater amplitude in the movement in $y(1)$ compared to x could be explained by changes in any or all of the following: the leverage rate, the imbedded interest rate, the tax rate on corporate profits, or the expected inflation rate. Between 1960 and 1967 the leverage rate, η, rose from .231 to .354, and the corporate tax rate, τ, fell from .487 to .421, so that both contributed to the rise in $y(1)$. The expected inflation rate, π, rose from .0083 to .0239, but its depressing influence on $y(1)$ was limited by the smaller rise in the imbedded interest rate, m, from .0363 to .0467. Also, the excess tax bill due to inflation and historical cost accounting actually went down.

The sharp fall in $y(1)$ between 1967 and 1980 was due primarily to the fall in x and to the rise in m. The latter rose from .0467 to .0870 in response to the rise in the inflation rate from .0239 to .0815.[5] Inflation also caused $\lambda\pi$ to increase from $-.0030$ to .0111, and $\lambda\pi$ contributed materially to the fall in $y(1)$. However, the 1980 value of $\lambda\pi$, with $\pi = .0815$, is less than one-half the value Feldstein would have predicted. Finally, η was practically unchanged between the two years, and, furthermore, the fall in τ moderaetd the fall in $y(1)$.[6]

The error in earnings measurement attributed to investors by M-C is corrected in $y(2)$ by adding $\eta\pi$ to $y(1)$. This correction had little impact in 1960 when the inflation rate was low: $y(2)$ was only slightly above $y(1)$ in that year. In 1980, however, inflation was considerable and the addition of $\eta\pi$ to $y(1)$ made $y(2)$ well above both its value in 1960 and the value of $y(1)$ in 1980.

Earnings, though, are of no direct interest to shareholders; they are of interest only for what they provide in the current dividend and in growth. The dividend provided (per dollar of equity) rose from .0316 in 1960 to .0393 in 1967, but it fell drastically to .0229 in 1980. The estimate of the expected rate of growth in share price arrived at in Table 1 is the product of the current values of b and r, the fraction of earnings retained and the rate of return on investment of retained earnings. Between 1960 and 1967 br rose from .0225 to .0520—due to a sharp

[5] Insofar as the imbedded interest rate can be expected to move closer to the current interest rate with the passage of time, both $y(1)$ and $y(2)$ are overstated for 1980.

[6] The debt-equity ratio for 1980 is overstated somewhat since the debt is actually at book value, and the rise in the current over the imbedded interest rate makes the book value somewhat less than replacement cost. This error has no material impact on the other statistics.

Table 1

Financial Statistics for the Domestic Operations of all Nonfinancial U.S. Corporations, 1960, 1967, 1978 and 1980

	1960	1967	1978	1980
q = end-of-year (EOY) net worth at market value divided by EOY net worth at replacement cost	.897	1.215	.422	.556
x = pre-tax profits at replacement cost plus net interest divided by average start-of-year (SOY) and EOY tangible assets.[1]	.0924	.1170	.0840	.0717
$y(1) = [1 - \tau][x(1 + \eta) - m\eta] - \lambda\pi$ = expected after-tax return on equity (unadjusted)	.0525	.0848	.0432	.0325
η = EOY net debt divided by EOY net worth at replacement cost[2]	.231	.354	.359	.339
τ = corporate liability divided by pre-tax corporate profits	.487	.421	.409	.343
m = net interest divided by average of SOY and EOY net debt[3]	.0363	.0467	.0837	.0870
i = EOY interest rate on Moody's Aa-rated bonds	.0450	.0638	.0933	.1378
π = expected rate of inflation[4]	.0083	.0239	.0650	.0815
$\lambda\pi$ = τ times excess of pre-tax corporate profits over pre-tax profits at replacement cost divided by average of SOY and EOY net worth at replacement cost	.0011	−.0030	.0099	.0111
$y(2) = y(1) + \eta\pi$ = expected after-tax return on equity (adjusted)	.0543	.0930	.0663	.0615
d = average of current and next year's dividends divided by EOY net worth at replacement cost	.0316	.0393	.0257	.0229
d/q = dividend yield	.0352	.0323	.0608	.0412
$b = [y(2) - d]/y(2)$ = expected fraction of earnings retained	.418	.577	.613	.627
$r = [1 - \tau][x(1 + \eta) - i\eta] - \lambda\pi + \eta\pi$ = expected rate of return on investment of retained earnings	.0538	.0901	.0646	.0490
br = expected rate of growth in dividends and earnings	.0225	.0520	.0396	.0307
$\underline{k} = d/q + br$ = deflated yield on shares (gross of personal taxes)	.0577	.0843	.1004	.0719
$k = d/q + br + \pi$ = nominal yield on shares (gross of personal taxes)	.0660	.1082	.1654	.1534

Sources: Income statement data are from U.S. Department of Commerce, Bureau of Economic Analysis *The National Income and Product Accounts for the United States, 1929–74, Statistical Tables*, a supplement to the *Survey of Current Business*; and from various monthly issues of the *Survey of Current Business*, vols. 56–60 (1976–1980). Balance sheet data are from Board of Governors, Federal Reserve System, "Sector Balance Sheets With Tangible Assets at Current Cost" (1945–1980), *Nonfinancial Corporate Business* (September 1981). The balance sheet data are adjusted to the domestic operations of U.S. nonfinancial corporations by eliminating U.S. direct investment abroad and foreign direct investment in the U.S. Current interest rate data are from *Moody's Industrial Manual*, vol. 1 (1981).

[1] Pre-tax profits at replacement cost include adjustments for inventory valuation and capital consumption. Tangible assets are net reproducible assets at replacement cost plus land at book value.

[2] Net debt is all liabilities less all nominal assets based on reported or book values.

[3] *The National Income and Product Accounts* did not report net interest separately for the corporate sector. It was approximated by deducting from domestic net interest the net interest in the agricultural, forestry and financial sectors.

[4] The price index used here for the actual inflation rate is the deflator for the gross domestic product of nonfinancial corporate business found in *The National Income and Product Accounts*. The expected inflation rate for year t is $\pi(t) = .6\pi(t - 1) + .4[z(t + 1)/z(t) - 1]$, where $z(t)$ is the price index for the year t.

rise in b and a very sharp rise in r. In 1980 br fell back to .0307, notwithstanding a further rise in b, because r fell by almost one-half from .0901 to .0490.

Shares are priced to provide investors with the yield they require, given the expected dividend rate, d, and the expected rate of growth, g. The pricing of shares makes the yield investors require, $d/q + g$, become $\underline{k} = d/q + br$, on the assumption that they take br as their estimate of g. Thus, we see that the estimate of $\underline{k}$ in Table 1 rose sharply between 1960 and 1967—from .0577 to .0843—but fell off to .0719 in 1980. Obviously, the nominal values of both yield and growth are their real values plus the inflation rate. The nominal yield, k, is given in the table.

As indicated earlier, an estimate of $\underline{k}$ in which g is derived from the current values of b and r is in error insofar as these current values are not considered representative of what will prevail in the future. This is the only source of error in our estimate of $\underline{k}$, since $\underline{k} = d/q + g$, and since d/q is measured free of error. Based on inspection of the values of br for other years between 1960 and 1980, I believe that more reasonable estimates of the "permanent" or long-run values of g for 1960, 1967 and 1980 are, respectively, .025, .043 and .031. Note that there is little difference between br and g for 1960, no difference for 1980, and that the large difference for 1967 recognizes the abnormally high value of x in that year. With these values for g, $\underline{k}$ becomes .060, .075 and .072 for the three years in question. The plausibility of these revised values for $\underline{k}$ will be discussed shortly.

We are now in a position to explain the change in q from 1960 to 1967 and then to 1980. For 1960 we have:

$$q = \frac{d}{\underline{k} - g} = \frac{.0316}{.060 - .025} = \frac{.0316}{.035} = .90, \tag{9}$$

and for 1967, $q = .0393/(.075 - .043) = 1.23$. With d rising from .0316 to .0393 between the two years, there would have been a rise in q to 1.12, if $\underline{k}$ and g had remained equal to their 1960 values. The somewhat greater rise in q to 1.23 was due to the large rise in g from .025 to .043 and the smaller rise in $\underline{k}$ from .060 to .075.

Comparing 1960 and 1980, we see that d fell sharply from .0316 to .0229—notwithstanding the increase in the earnings on equity, $y(2)$, due to the *sharp* fall in the fraction of earnings paid in dividends. If $\underline{k}$ and g had remained equal to their 1960 values, there would have been a fall in q from .90 to .65. The actual fall in q to $.0229/(.072 - .031) = .56$ in 1980 was due to the greater increase in $\underline{k}$ than in g over the twenty-year period. The increase in g was small—notwithstanding the large increase in the fracation of earnings retained—because the return on retained earnings fell somewhat over the period.

It should be noted that the values of q for 1960, 1967 and 1980 arrived at through Eq. (9) did not invoke either of the errors attributed to investors by M-C. That is, the erosion in the value of debt due to inflation was included in our figures for both earnings and the return on equity investment, and the discount rate used to value real cash flows was the real, not the nominal discount rate.

For investors to make the errors attributed to them by M-C, we would have to: (1) use $y(1)$ instead of $y(2)$ in arriving at b; (2) delete $\eta\pi$ in arriving at r; and, most important, (3) use the nominal discount rate, $k = \underline{k} + \pi$, in determining q.

Changing b and r accordingly for 1980, we would get $br = \underline{g} = .007$, and employing the nominal discount rate, $k = .072 + .082 = .154$, we would get

$$q = \frac{.023}{.154 - .007} = .156. \tag{10}$$

Comparing this .156 with our .56 for 1980, it is clear that the stock market would have been in far worse shape if investors had made the errors attributed to them by M-C.[7]

Before concluding, some comment may be desirable on our substantially higher values for $\underline{k}$ in 1967 and 1980 compared to 1960. One may think of $\underline{k}$ as being the sum of the real, risk-free interest rate and the risk premium on the "market portfolio," and it has been argued that these are highly stable over time. However, a number of considerations support the plausibility of our finding that $\underline{k}$ rose substantially:

(1) The U.S. came out of the Second World War with an extraordinarily large fraction of wealth in bonds and other monetary assets, so that only a small risk premium on shares was needed to persuade investors to accept this distribution of wealth between bonds and shares. As a result, the risk premium may have remained depressed as late as 1960.

(2) Along with the rise in the rate of return between 1960 and 1967, corporations increased the fraction of their profits retained (i.e., saved), and the return investors required on shares in aggregate increased with the substitution of future dividends for current dividends.[8]

(3) While the fraction of profits saved increased, the fraction of national income saved fell over the postwar years. In other words, while the demand curve for savings shifted up, the supply curve shifted down. Hence, both developments tended to raise the real values of the interest rate and the yield on shares.

(4) The increase in uncertainty with inflation over the 1970s that was found by F-H would tend to raise the real yield on shares.

(5) The rise in the inflation rate over the 1970s would raise $\underline{k}$, the real yield on shares gross of the personal income tax, if $\underline{\kappa}$, the post-tax yield, is independent of the inflation rate.

To elaborate on this fifth consideration, the relation between these two yields is given by the expression:

$$\underline{\kappa} = \underline{k} - \theta d/q - c(\underline{g} + \pi). \tag{11}$$

[7] However, we cannot be sure that investors actually avoided these errors. M-C assumed that investors were too naive to avoid them but sophisticated enough to adjust reported earnings and equity to a replacement cost basis. It is possible, though, that investors are so naive that they make no adjustment whatsoever to reported data. Such a complete lack of sophistication would be consistent with the observed values for q, if the compensating errors make the fully adjusted data not far different from the reported data.

[8] Although there is considerable empirical evidence that growth stocks sell at higher yields than dividend stocks, it is not generally accepted that the yield at which a share sells increases with its growth rate. However, correlation between yield and growth in aggregate merely requires that the interest rate vary with the demand for savings.

Reasonable values for the noncritical variables in Eq. (11) are $\theta = .3$, $d/q = .035$, $c = .15$, and $g = .025$. With these values and with $\underline{k} = .06$ when $\pi = 0$, the post-tax yield is $\underline{\kappa} = .0458$. If we assume $\underline{k}$ remains unchanged when the inflation rate rises to $\pi = .07$, then $\underline{\kappa}$ would fall to .0353. However, under the more reasonable assumption that as π rises to .07, $\underline{\kappa}$ remains equal to .0458, $\underline{k}$ would rise from .06 to .0702. Under the second assumption, practically the entire increase in the pre-tax share yield between 1960 and 1980 would be due to the personal tax consequences of inflation.

The major conclusion we have reached is that the large fall in q, the ratio of the market value of equity to its replacement cost, between 1960 and 1980 can be adequately explained by the fall in corporate profitability and the rise in the pre-tax yield that investors require on shares. The decline in profitability made the small rise in expected growth inadequate to offset the large reduction in the dividend per dollar of equity. A number of factors contributed to the rise in the required yield, among which the rise in the effective rate of the personal tax on share income is directly attributable to the rise in the inflation rate. Thus we see that irrationality in valuing shares on the part of investors need not be invoked to explain the fall in q.

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DISCUSSION

ZVI BODIE*: I find myself in complete agreement with Elton, Gruber, and Rentzler (EGR) regarding the significance of the topic they have chosen to deal with and their basic theoretical results. I think they have done a fine piece of work. My main purpose in these comments is to clarify some aspects of their paper by highlighting its connection to the work of those who have applied

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