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3 Debt and Equity Yields, 1926–1980

Patric H. Hendershott and Roger D. Huang

An important companion to a study of how corporations have issued and investors have purchased debt and equity securities during the past half century is an examination of how these securities have been priced in this interval. Both resource utilization and inflation have varied widely in the American economy, causing sharp changes in security prices and thus enormously diverse ex post returns on corporate equities and bonds. Even if we limit ourselves to the post-Accord (1951) years, the variation in returns is huge. To illustrate, equities earned positive *real* returns in 1954, 1958, and 1975 of 54%, 41%, and 30%, respectively, but had −24% and −38% returns in 1973 and 1974. Variations in real returns on high-quality corporate bonds were smaller, but in the double-digit range nonetheless (14% in 1970 and 1976 and −13% to −16% in 1969, 1974, 1979, and 1980). The primary purpose of this study is to increase our understanding of the determinants of these variations.

The study is divided into four broad parts. We begin with an exploratory analysis of the data for the 1926–80 period. It makes good analytical sense to examine the data for any regularities without the imposition of too much structure before studying the data in the confines of a particular

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model. In section 3.2, we estimate the relationships between one-month ex post returns on corporate bonds and equities and variations in Treasury bill rates, economic activity, and other variables. The major other variable is unanticipated changes in new issue coupon rates on long-term Treasury bonds. Sections 3.3 and 3.4 contain econometric investigations of the determinants of one-month Treasury bill rates and unanticipated changes in long-term Treasury coupon rates, respectively. These parts perform two functions: they extend the analysis of section 3.2 by explaining variables that determine ex post corporate bond and equity returns, and they provide evidence on the determination of new issue yields on short- and long-term default-free debt. The first part of the study differs from the others in that it consists of simple numerical analysis (plots, calculation of means, etc.) rather than formal econometrics, and considers data from the entire 1926–80 period rather than the 1953–80 span.

A number of important issues are addressed in the econometric parts of the paper. These include the validity of the Modigliani-Cohn valuation-error hypothesis, the measurement of Merton's "excess return on the market," the relationship between real new-issue debt rates and real economic activity, and the usefulness of the Livingston survey data in explaining financial returns.

Three general datasets are analyzed. First, the ex post returns on bills, bonds, and equities are those compiled by Ibbotson and Sinquefield (1980); causality tests of relationship among these returns and inflation are reported in Appendix A. Second, changes in the coupon rate on long-term, new-issue-equivalent Treasury bonds and unanticipated changes in this rate are based upon the work of Huston McCulloch and are described in Appendix B. Third, unanticipated inflation and industrial production growth are derived from the Livingston survey data, and they and the entire semiannual dataset utilized in the analysis of unanticipated changes in new-issue coupon rates are presented in Appendix C.

3.1 Exploratory Data Analysis

This part of the study contains sections dealing with (1) inflation and Treasury bill rates; (2) inflation and relative returns on equities, bonds, and bills; and (3) the business cycle and returns on equities and bonds.

Before turning to the analysis, a few words about the data are in order. First, all of the underlying yield data compiled by Ibbotson and Sinquefield—equities, corporate bonds, Treasury bonds, and Treasury bills—are roughly representative of returns on economy-wide "market" portfolios and are available monthly for the 1926–80 period. These yields are realized, rather than expected, returns, except for those on Treasury bills which are both expected and realized because their one-month maturity equals the period over which the returns are calculated. Second, the returns—income plus capital gains (except for bills)—are before-tax returns. They are not truly representative of what either highly taxed or tax-exempt investors actually earned after tax (both investor groups presumably would have opted for portfolios with relative income and capital gains components different from the market average, and the former group, of course, paid taxes). Hopefully, differential returns, at least, are roughly representative of those earned by most investors.

The inflation rate is the rate of change in the consumer price index for the 1926–46 period and the rate of change in the consumer price index net of the shelter component after 1946. The latter circumvents the erroneous treatment of housing costs (especially mortgage interest) in the construction of the basic CPI (see Blinder 1980; Dougherty and Van Order 1982).

3.1.1 Inflation and Treasury Bill Returns

During the 1926–80 period there was a single episode of significant deflation, 1930–32. In those three years the inflation rate ranged from −6% to −10%. Modest deflation also occurred in 1926–27, 1938, and 1949. In contrast, there have been three significant bursts of inflation—the beginning of World War II (9% in 1941 and 1942), the postwar surge (18% in 1946 and 9% in 1947), and the Korean War scare (6% in 1950 and 1951)—and the prolonged post-1967 inflationary era. The current inflation has ranged from slightly over 4% (adjusting for the impact of price controls in 1971–72) to double-digit inflation in 1974 and again in 1979–80.

The above overview of the 1926–80 period suggests that division of these years into four subperiods might be useful. These are 1926–40 (which includes the Depression and all years of even modest deflation except 1949), 1941–51 (which includes the inflationary spurts of World War II, its aftermath, and the outbreak of the Korean conflict), 1952–67 (the era of stable prices), and 1968–80 (the present inflationary period). The first two columns of table 3.1 present the mean and standard deviations for the annual inflation rate for these and overlapping periods. The great differences in the mean inflation rate and its variability are obvious.

The next four columns list means and standard deviations for both the nominal and real one-month Treasury bill rate. As can be seen, there is an enormous difference in the variability of the real bill rate between 1926–51 and 1952–80. In the latter period the standard deviation of the real bill rate, 1.5%, is only three-fifths of that of the nominal bill rate, 2.6%; in the earlier period, the former, 6.4%, is over five times the latter, 1.2%. Division of the earlier interval into 1926–40 and 1941–51 reveals enormous variability in the real bill rate (and stability in the nominal rate). The mean real bill rate was a full 2.8% in 1926–40 and an incredible −5.4% in 1941–51. The negative real rate in the 1940s was due to the

Table 3.1 Annual Inflation and Nominal and Real One-Month Treasury Bill Rates

	Inflation Rate		Nominal Bill Rate		Real Bill Rate	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1926–40	−1.5	4.0	1.3	1.5	2.8	4.5
1941–51	6.0	5.3	.6	.4	−5.4	5.5
1952–67	1.5	1.2	2.7	1.0	1.2	0.8
1968–80	7.1	3.1	6.7	2.2	−0.4	1.8
1926–51	1.7	5.9	1.0	1.2	−0.6	6.4
1952–80	4.0	3.6	4.5	2.6	0.5	1.5

Note: The real bill rate is the nominal rate less the inflation rate. Annual rates are geometric averages of the 12 monthly rates during calendar years.

monetary authorities' policy of pegging nominal interest rates at low levels during a period of significant inflation. The high real rate in the 1930s is largely attributable to the combination of the general nonnegativity constraint on the nominal rate and the existence of significant deflation. However, it is noteworthy that the real bill rate exceeded 4% in all years in the 1926–30 period during which the nonnegativity constraint was not binding (the nominal bill rate ranged from 2.4% to 4.7%).

Figure 3.1 illustrates the marked difference between the 1926–51 and 1952–80 periods in the volatility of both the nominal and real bill rates. In the former period, the nominal rate declines in the early 1930s and is then

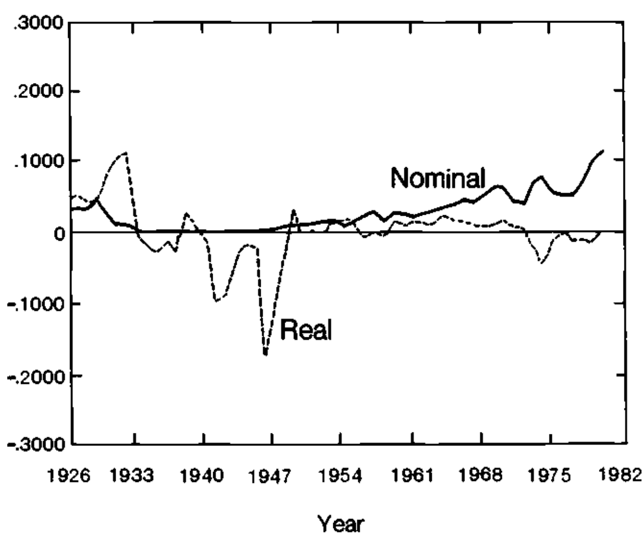

Fig. 3.1 Real and nominal Treasury bill rates, 1926–80.

flat; in the latter period this rate cycles around a sharply rising trend (the 1980 average bill rate of almost 12% disguises variations in monthly rates between less than 7% and over 16%). In contrast, the real bill rate varied between +12% in 1931 and 1932 and −18% in 1946. Its often-cited stability clearly refers to the post-1951 period only.[1]

3.1.2 Inflation and Relative Returns on Equities, Bonds, and Bills

The first two columns in table 3.2 repeat the same columns in table 3.1. The third and fourth columns record the mean and standard deviation of the difference between the annual returns on equities and corporate bonds. As can be seen, the premiums equities have earned over bonds have varied widely. The premium was much greater in the 1940s, 1950s, and 1960s than in the 1930s and 1970s.[2] It would appear from these data that there is no simple relationship between the premium and either the mean or the standard deviation of the inflation rate.[3]

The last two columns in table 3.2 report the mean standard deviation of the difference between the annual returns earned on U.S. government bonds and one-month bills. The difference was extraordinarily large, 3.8%, in the 1926–40 period, and small, −2.5%, in the 1968–80 period. These differences are due to apparently unanticipated movements in interest rates.[4] To illustrate, if yields fall unexpectedly, then prices of long-term bonds will rise unexpectedly, and the one-year return on bonds will be large. This was apparently the case in the 1930s (the one-month bill rate declined from an average of over 3.0% in 1926–30 to less than 0.5% in the 1933–40 period). In contrast, if yields rise unexpectedly, then prices of long-term bonds will fall unexpectedly, and the one-year return on bonds will be low. This apparently has happened in the post-1952 period (the one-month bill rate rose from 1.5% in 1952–55 to 5% in 1967–69 to over 10% in 1979–80).[5]

It is important to note that only unanticipated movements in interest rates have such impacts on the difference in realized returns on bonds and bills. For example, if long-term bond rates were expected to rise during the year, then bonds would be priced at the beginning of the year such

Table 3.2 **Annual Inflation and the Returns on Equities (Relative to Bonds) and Bonds (Relative to Bills)**

	Inflation Rate		Corporate Equities Less Bonds		Treasury Bonds Less Bills	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1926–40	−1.5	4.0	2.2	28.7	3.8	5.3
1941–51	6.0	5.3	13.2	14.8	1.5	4.0
1952–67	1.5	1.2	12.6	19.7	−1.1	5.8
1968–80	7.1	3.1	4.0	16.2	−2.5	7.8

that a high income return would offset the anticipated capital loss. In this case, the difference in ex post returns on bonds and bills would be independent of observed changes in new-issue bond yields.

3.1.3 The Business Cycle and Returns on Equities and Treasury Bonds

In this section, we explore the presence of a business cycle effect on returns earned on investment in corporate bonds and stocks. The reference dates of the National Bureau of Economic Research are employed as a general guide to the stages of the business cycle. In the 1926–80 period, 10½ cycles have occurred (see table 3.3). Excluding the 43-month depression, contractions have ranged from 6 to 16 months and have had an average duration of 11 months. Excluding the 80- and 106-month wartime (World War II and Viet Nam) expansions, upswings have varied from 21 to 59 months in duration and have averaged 39 months.

Annualized differences in ex post equity and bond returns over different phases of the business cycle have been compared.[6] For contractions, the first and last 5 months (which overlap for contractions of less than 10

Table 3.3 Business Cycle Reference Dates: 1926–80

Business Cycle Reference Dates: Trough	Business Cycle Reference Dates: Peak	Duration in Months: Contraction (Previous Peak to Trough)	Duration in Months: Expansion (Trough to Peak)
November 1927	August 1929	13	21
March 1933	May 1937	43	50
June 1938	February 1945	13	80
October 1945	November 1948	8	37
October 1949	July 1953	11	45
May 1954	August 1957	10	39
April 1958	April 1960	8	24
February 1961	December 1969	10	106
November 1970	November 1973	11	36
March 1975	January 1980	16	59
July 1980		6	—
Average, all cycles:			
11 cycles, 1926–1980		14[a]	50[b]
5 cycles, 1926–1953		18[a]	47[b]
6 cycles, 1953–1980		10	53[b]

Source: National Bureau of Economic Research.

Notes:

[a]11 months, excluding the Great Depression.

[b]39 months, excluding the World War II and Vietnam cycles.

months duration) were examined. For expansions, the first, second, third, and last 6 months were studied (the last two periods overlap during the 21 month upswing in the late 1920s). The cycles were divided into the 1926–52 and 1953–80 subperiods, and means and standard deviations of the differences in equity and bond returns were calculated for the 5 pre-1953 cycles, the 5½ post-1952 cycles, and all 10½ cycles. A cursory examination of the data revealed that equities tend to earn a relatively superior return (i.e., greater than the average 7% by which equity returns exceeded bond returns throughout the entire 1926–80 period) late in contractions and early in expansions and a relatively inferior return late in expansions and early in contractions.

A systematic comparison of the return data is reported in table 3.4. We first divided the months between January 1926 and December 1980 into three types of periods: those around troughs (in which equity returns appear to be superior), those around peaks (in which equity returns appear to be relatively inferior), and the remainder. The inferior periods are defined as the last 6 months of every expansion and the first half (dropping fractions) or first 6 months, whichever is less, of every contraction. The superior periods are defined as the last half (dropping fractions) or last 6 months, whichever is less, of every contraction and the first 6 months of every expansion. In the second step in this comparison, the total 1926–80 period is partitioned into 11 overlapping intervals that contain single adjoining peaks and troughs and all the surrounding months that do not overlap with adjacent superior and inferior periods. That is, the intervals extend from 6 months after a trough to 6 months before the second following peak. These 11 overlapping intervals are listed at the left in table 3.4. Also listed are the geometric mean returns (annualized) during the superior periods within the interval, the inferior periods, and all months excluding such periods. The mean in the latter months is the "normal" return to which the mean returns around the trough and peak are compared.[7]

Columns 4 and 5 are the differences between the superior and inferior returns, respectively, and the normal returns. The extraordinary annual net returns on equities around troughs average 26% (no net return is less than 18%), and the standard deviation is only 11%. In contrast, the extraordinary annual net returns on equities are negative around most peaks, and these net returns average −13%. Here, however, the standard deviation is a relatively large 17%.

These results indicate that investors could devise superior trading schemes involving transactions between equities and government bonds to the extent that they were able to forecast the turning points of business cycles, particularly the recession trough. Given the brevity of the post–World War II recessions, this would not appear to be difficult; when a recession is clearly upon us, the trough is just around the corner. Unfor-

Table 3.4 Geometric Difference between Returns on Equities and Treasury Bonds, Near Troughs, Near Peaks, and in Other Periods (%)

	Near Troughs	Near Peaks	Other Months	Excess Near Troughs	Excess Near Peaks
January 1926–February 1929	37	19	17	20	2
June 1928–November 1936	24	−12	−6	30	−6
October 1933–August 1944	26	−32	8	18	−40
January 1939–May 1948	31	17	1	30	16
May 1946–January 1953	35	−10	12	23	−22
May 1950–February 1957	43	−4	20	23	−24
December 1954–October 1959	46	−10	16	30	−26
November 1958–June 1969	32	−14	8	24	−22
September 1961–May 1973	27	−11	6	21	−17
June 1971–July 1979	27	−10	3	24	−13
October 1975–December 1980	56[a]	13[b]	4[c]	51	9
Mean	35	−5	8	26	−13
S.D.	10	15	8	11	17

Note:
[a]Covers the period May 1980–December 1980.
[b]Covers the period August 1979–April 1980.
[c]Covers the period October 1975–July 1979.

tunately, such a trading rule will lead to incredibly negative returns if the early 1930s are ever repeated.

3.2 Ex Post Returns and the Interest Rate and Business Cycles

Our next task is to explain ex post monthly returns on corporate bonds and equities. The analytical framework, which follows Mishkin (1978, 1981), is first developed and then empirical results for bonds and equities are reported.

3.2.1 The Analytical Framework

The ex post after-tax return on an asset equals the expected or required return plus the difference between the ex post and expected returns. With the required return equal to the after-tax return on one-month Treasury bills plus a risk/liquidity premium, we have

$$(1)\qquad (1-\tau^j)R^j_{t+1} = (1-\tau)R_{t+1} + \rho^j + \text{UNEX}^j_{t+1},$$

where ρ^j is the premium required on the jth asset and UNEX_{t+1} is the difference between the ex post and anticipated after-tax return on asset j that occurs because of unexpected changes in variables relevant to the return on asset j. Next ρ^j and UNEX_{t+1} are replaced by a constant plus a set of responses to proxies for them (X_i^j) and an error term (η^j) to obtain

$$(2) \qquad R_{t+1}^j = \beta_0^j + \beta_1^j R_{t+1} + \sum_{i=2}^{u} \beta_i^j X_{i,t+1}^j + \eta_{t+1}^j ,$$

where $\beta_1 = (1 - \tau)/(1 - \tau^j)$. The difficult problem is, of course, specification of the X_i's.

Unanticipated Changes in Treasury Coupons. In section 3.2, it was suggested that changes in new-issue-equivalent 20-year Treasury bond yields have been largely unanticipated during the 1952–80 period. This proposition can be tested with data compiled by Huston McCulloch. For the 1947–mid-1977 period, McCulloch (1977) has meticulously constructed monthly series for both (1) new-issue-equivalent (par value) long-term Treasury bond yields and (2) cumulative unanticipated changes in these yields.[8] A regression of the monthly change in the 20-year new-issue yield ($\Delta R20$) on the unanticipated change ($UN\Delta$) over the January 1953–June 1977 period results in

$$\underset{}{\Delta R20} = \underset{(.34)}{1.27} + \underset{(.021)}{.999}\, UN\Delta, \qquad R^2 = .882,\ \text{D-W} = 2.88,\ \ \text{SEE} = 5.9 \text{ basis points},$$

where the yields are at annual rates. The positive constant reflects the generally upward slope of yield curves, and the response to unanticipated changes is clearly one for one. The adjusted R^2 indicates that 88% of monthly changes other than the constant are explained by the unanticipated change.

In equation estimates reported below, variables based on both $\Delta R20$ and UN will be employed (the latter in equations excluding data after June 1977). The specific form of the variables depends on how an unexpected change in the bond rate should affect the price of (capital gain on) the specific security being analyzed. The percentage capital gain on a portfolio of n-year bonds (CG_b) is related to changes in the yield on the n-year bond, ΔR_n, by

$$CG_b = -\frac{\Delta R_n[(1 + R_n)^n - 1]}{R_n(1 + R_n)^n} .$$

In the regressions reported below, n is set equal to 20. With CG_b defined in this way, its coefficient is expected to be near unity.

For equities, the relationship between the capital gain component of the yield and the unanticipated change in the new-issue coupon rate is more complicated. The perpetual dividend growth valuation model says that the value of equities (V) equals current after-tax dividends $[(1 - \tau_d)D]$ divided by the required after-tax nominal return on equities (R_e^a) less the expected rate of appreciation in dividends (g):

(3) $$V = \frac{(1-\tau_d)D}{R_e^a - g}.$$

Taking derivatives, the percentage capital gain on equities, dV/V, is related to changes in the 20-year coupon rate by

$$CG_e = -\frac{d(R_e^a - g)}{dR20}\frac{\Delta R20}{R_e^a - g}.$$

The issues are, How should $R_e^a - g$ be measured, and what is the likely value of the derivative of $R_e^a - g$?

Portfolio equilibrium requires that

(4) $$R_e^a = (1-\tau_d)R20 + \rho,$$

where bonds and dividends are assumed to be taxed equivalently and ρ is a required risk premium. Thus

$$R_e^a - g = (1-\tau_d)R20 + \rho - g,$$

and

(4′) $$\frac{d(R_e^a - g)}{dR20} = 1 - \tau_d - \frac{dg}{dR20}.$$

Equation (4′) suggests the following. First, if all changes in $R20$ are due to changes in expected inflation which are, in turn, reflected in $g(dg/dR20 = 1)$, then $d(R_e^a - g)/dR20$ equals $-\tau_d$ and CG_e is positive. Second, for low values of τ_d, $R_e^a - g$ is roughly constant. This joint hypothesis suggests the use of $\Delta R20/0.06$ as a regressor, with an expected positive coefficient of τ_d.[9] On the other hand, if x percent of changes in $R20$ are due to changes in the real rate of interest and thus $dg/dR20 = 1 - x$, then the coefficient on the regressor would be $-(x - \tau_d)$. Ideally, one would separate changes in interest rates into nominal and real components and enter these in the regressions separately. Such a separation of monthly changes would seem to be nearly impossible and is not attempted here.

An alternative view of equity valuation exists. Equation (4) assumes that investors rationally compare nominal returns on debt and equities. In contrast, Modigliani and Cohn (1979) have contended that investors compare real equity returns with nominal debt returns and that this error has been the cause of the dismal performance of equities during the 1966–80 period of rising inflation. To test this hypothesis, (4) is replaced with

(4a) $$R_e^a - \pi = (1-\tau_d)R20 + \rho.$$

In this case

$$R_e^a - g = (1-\tau_d)R20 + \rho - g + \pi.$$

Taking derivatives,

$$\text{(4a}'\text{)} \qquad \frac{d(R_e^a - g)}{dR20} = 1 - \tau_d - \frac{dg}{dR20} + \frac{d\pi}{dR20} \sim 1 - \tau_d .$$

If Modigliani and Cohn are correct, then the appropriate regressor is $\Delta R20/[(1 - \tau_d)R20 + .04]$—we take the real component of g to be 0.02—and the expected coefficient is $-(1 - \tau_d)$. Whether changes in interest rates are perceived to be real or nominal is irrelevant (g and π change equally in any event) to investors and thus to equity prices. In the empirical work reported below, both the rational and Modigliani and Cohn views will be tested. In these tests, we shall set $\tau_d = 0.3$ (see n. 17 for results with other values of τ_d).

Of course, $R20/.06$ and $R20/[(1 - \tau_d)R20 + .04]$ are closely correlated, being dominated by their numerators. Thus, if one "works," so will the other. If neither works, then we will accept the rationality hypothesis with $x = \tau_d$. If both work positively, then the Modigliani-Cohn hypotheses will be rejected. If both work negatively, we will choose between the rationality and Modigliani-Cohn hypotheses on the basis of the plausibility of the implied estimates of x and τ_d.

Other Variables. In section 3.1.3, it was established that equities earned extraordinarily large returns relative to bonds around recession troughs, very likely because of a turnaround in expectations regarding the growth of the economy. We would expect this to generate capital appreciation on equities and possibly bonds (if default premia decline). Based on the earlier analysis, a turnaround dummy variable is defined as:[10]

$$\text{TURN} = \begin{cases} 1 & \text{last half (dropping fractions) or last 6 months,} \\ & \text{whichever is less, of every contraction and first} \\ & \text{6 months of every expansion} \\ 0 & \text{elsewhere.} \end{cases}$$

A final proxy is unexpected inflation. This variable is measured as the difference between actual and expected inflation where the latter is based on the Livingston survey data.[11] More specifically, the variable is the difference between the actual average monthly inflation rate between the survey date and the date forecast and the Livingston forecasted 6-month inflation rate converted to a monthly basis. Because the forecasts are available only semiannually, our proxy changes value only every 6 months.[12] Because price surprises appear to lead declines in real economic activity—there is a strong negative correlation between our unanticipated inflation variable and the growth rate of industrial production in the following year—the surprises should be expected to depress equity returns (and possibly bond returns if default premia rise).[13]

3.2.2 The Results for Bonds

The results for corporate bonds are reported in table 3.5. Equations (T1) and (T2) are for the 1953–mid-1977 period and differ only in that (T1) includes the capital gains variable based on the unexpected change in the 20-year Treasury rate as a regressor while the variable in (T2) is based on the total change.[14] Given our earlier evidence that changes in the 20-year rate are largely unanticipated, it is not surprising that the results are quite similar. The bill rate coefficients are close to their expected value of unity. On the other hand, the capital gain coefficients are only about 70% of their expected unity value. The unanticipated inflation and superior dummy variables enter with the expected signs, but only the coefficient on the former is significantly different from zero at the .05 level.

Equation (T3) contains estimates for the entire 1953–80 period. The coefficient on the bill rate is now quite close to the expected unity value, and the explanatory power of the equation increases sharply (R^2 rises from .56 to .68). The coefficient on the capital gain variable, .76, is closer to unity, but still significantly below, and the other coefficients, while continuing to have the expected signs, are not significantly different from zero. These coefficients are not small, however. Bond returns tend to be 2.3% less than normal in a year of 2.5% unanticipated inflation and 2.3% more in the year surrounding business cycle troughs.

3.2.3 The Results for Equities

Hendershott and Van Horne (1973, pp. 304–5) observed that the new-issue bond yield and Standard and Poor's dividend-price ratio moved in opposite directions throughout the 1950s (they conjectured that a sharp decline in the relative risk premium required on equities occurred) but were positively correlated in the 1960s and early 1970s. Consequently, the 1953–80 period is divided into the 1953–60 and 1961–80 subperiods and results are reported for these.

Equation (T1) in table 3.6 illustrates the familiar, but hardly explicable, result that ex post equity returns were strongly negatively correlated with expected inflation in the 1950s.[15] The point estimate is an astounding -16, indicating that a one-percentage-point increase in the bill rate (expected inflation?) induced a 16-percentage-point decline in equity returns. Equation (T2) indicates the expected negative relationship with our unanticipated inflation variable (the average monthly inflation rate between the date the Livingston survey was taken and the date forecast less the Livingston forecasted 6-month inflation rate) and positive relationship with the turnaround cycle dummy variable, but neither relationship is statistically significant. Equations (T3) and (T4) include current and lagged one-month values of the variables based upon changes in the long-term Treasury coupon rate. The variables in equations (T3) and (T5) are the Modigliani-Cohn nominal rate versions defined as $\Delta R20/(.7$

Table 3.5 **Explanation of Monthly Realized Returns on Corporate Bonds**

Period	Constant	Bill Rate	Capital Gain Variable[a]	Turnaround Dummy	Unanticipated Inflation	R^2 (SEE)
(T1) 1953–mid-1977	.00020	1.230	.720	.00257	−1.162	.577
	(.00168)	(.523)	(.038)	(.00178)	(.638)	(.0117)
(T2) 1953–mid-1977	.00113	1.276	.659	.00284	−1.321	.560
	(.00172)	(.532)	(.036)	(.00182)	(.651)	(.0119)
(T3) 1953–1980	.00216	.898	.764	.00191	−.908	.677
	(.00141)	(.388)	(.029)	(.00169)	(.582)	(.0119)

[a]The variable entered in eq. (T1) is based on the unexpected change in the 20-year, new-issue rate; in the other equations the variable is based on the total change.

Table 3.6 Explanation of Monthly Realized Equity Returns, 1953–60

Eq.	Constant	One-Month Bill Rate	Unanticipated Inflation	Turnaround Dummy	Changes in Coupon Rate[a] Current	Changes in Coupon Rate[a] Lagged	$\bar{R}^2$ (SEE)
(T1)	.0410	−16.005	—	—	—	—	.108
	(.0086)	(4.494)					(.0336)
(T2)	.0315	−10.752	−3.457	.0139	—	—	.115
	(.0112)	(5.528)	(3.410)	(.0096)			(.0335)
(T3)	.0263	−8.173	−4.069	.0154	.397	−.282	.173
	(.0112)	(5.452)	(3.410)	(.0095)	(.173)	(.176)	(.0323)
(T4)	.0262	−8.125	−4.084	.0155	.362	−.262	.167
	(.0112)	(5.467)	(3.418)	(.0095)	(.163)	(.165)	(.0324)
(T5)	.0095	1.0	−5.606	.0244	.421	−.285	.163
	(.0051)		(3.318)	(.0079)	(.174)	(.177)	(.0327)
(T6)	.0095	1.0	−5.628	.0245	.384	−.268	.163
	(.0052)		(3.323)	(.0079)	(.164)	(.167)	(.0327)

[a]This variable equals $\Delta R20/(.7\ R20 + .04)$ in the odd-numbered equations and $\Delta R20/.06$ in the even-numbered equations.

$R20 + 0.04$); the variables in equations (T4) and (T6) are the real rate versions defined as $\Delta R20/0.06$. A one-month lag was tested because equities and new-issue bonds are not as close substitutes as are corporate and Treasury bonds. Recall that the coefficients in (T3) are expected to be negative and sum to -0.7 if investors make the Modigliani-Cohn valuation error (and the tax rate on dividends is 0.3), and the coefficients in (T4) can be interpreted as $-(x - \tau_d)$, where x is the portion of changes in $R20$ due to changes in real coupon rates and τ_d is the tax rate on dividends. A positive relation between equity returns and the concurrent change in the bond yield is indicated, although the effect is largely reversed the following month.[16] This is inconsistent with the Modigliani-Cohn hypothesis and supports the rationality hypothesis. The implied dividend tax rate, assuming that changes in interest rates are perceived as nominal ($x = 0$), is 0.1 (when the lagged term is taken into account) to 0.36.

While the bill rate coefficient is still a startling -8 in equations (T3) and (T4), it is not significantly different from the expected unity value. In equations (T5) and (T6) this coefficient has been constrained to unity. As anticipated, the decline in explanatory power is minor. The impact of changes in Treasury coupon rates is unchanged from equations (T3) and (T4), but the coefficients on unanticipated inflation and the turnaround dummy rise in absolute value and statistical significance (the t-ratios are 1½ and 3, respectively).

Equations for the 1961–80 period are listed in table 3.7. While the Treasury bill rate enters negatively in equation (T1), the coefficient is only a tenth as large as that in equation (T1) of table 3.6. Moreover, when unanticipated inflation and the turnaround dummy variable are included, the bill rate coefficient is close (given its standard error) to unity. The coefficients on unanticipated inflation and the turnaround dummy have the expected signs and are significantly different from zero. Equations (T3) and (T4) contain the change in coupon rate variables. The coefficients in equation (T3) sum to -0.6, very close to the expected value of -0.7 in the Modigliani-Cohn framework (further lagged values of the variable have essentially zero coefficients), and the variables add substantially to the explanatory power of equation (T2).[17] The coefficients in equation (T4) sum to -0.33, implying that most of changes in long-term coupon rates (one-third plus the dividend tax rate) have been perceived by rational investors (not Modigliani-Cohn investors) as changes in real rates. The rationality of this perception, during a period of rising inflation, is questionable.

When the bill rate coefficient is constrained to unity (see eq. [T5] and [T6]), the other coefficients are little affected except for that on unanticipated inflation which falls by a quarter in absolute value. Because its

Table 3.7 **Explanation of Monthly Realized Equity Returns, 1961–80**

Eq.	Constant	One-Month Bill Rate	Unanticipated Inflation	Turnaround Dummy	Changes in Coupon Rate[a] Current	Changes in Coupon Rate[a] Lagged	$\bar{R}^2$ (SEE)
(T1)	.0147	−1.575	—	—	—	—	.001
	(.0066)	(1.352)					(.0417)
(T2)	.0025	2.162	−6.437	.0253	—	—	.085
	(.0071)	(1.906)	(2.491)	(.0071)			(.0399)
(T3)	.0020	2.770	−6.062	.0215	−.326	−.272	.149
	(.0069)	(1.877)	(2.425)	(.0070)	(.099)	(.101)	(.0385)
(T4)	.0005	3.173	−6.479	.0222	−.178	−.156	.141
	(.0070)	(1.907)	(2.441)	(.0070)	(.060)	(.062)	(.0387)
(T5)	.0075	1.0	−4.445	.0227	−.333	−.254	.156
	(.0036)		(1.714)	(.0069)	(.098)	(.099)	(.0385)
(T6)	.0073	1.0	−4.507	.0237	−.181	−.139	.147
	(.0036)		(1.723)	(.0069)	(.060)	(.060)	(.0387)

[a]This variable equals $\Delta R20/(.7\ R20\ +\ .04)$ in the odd-numbered equations and $\Delta R20/.06$ in the even-numbered equations.

standard error falls proportionately, the statistical significance of the coefficient is unaltered.

Comparisons of equations (T5) and (T6) in table 3.6 with their counterparts in table 3.7 indicates a close similarity of all coefficients except those on the current change in the Treasury coupon rate. Given this similarity, equations for the entire 1953–80 period have been estimated and are reported as equations (T1) and (T2) in table 3.8. The estimates are, of course, close to those of the subperiods. The coefficients in equation (T2) can be interpreted in the following way. First, the constant term, which is 0.102 on an annual basis, represents Merton's excess expected return on the market. Second, the bill rate contributed an average 4½% return over the period, rising steadily from under 2% in the early 1950s to over 10% in 1979–80. Third, the continuing climb in the Treasury coupon rate lowered stock returns by nearly 2% per annum on average during the 1953–80 period. More important, the change in this rate has had large impacts in particular years. To illustrate, the percentage increase in the coupon rate from 9% to 12½% between March 1979 and March 1980 generated a 15% ex post decline in stock returns in that year, other things being equal. Fourth, the coefficient on the turnaround dummy variable suggests that equities have earned a 34% greater return in the year roughly surrounding business cycle troughs than during other periods. Fifth, stocks have earned sharply negative returns, ceteris paribus, during periods of unanticipated inflation. More specifically, the roughly 4½ percentage point unanticipated inflation in 1973–74 and 1979 translates into a 22% lower annual return on equities than would otherwise be the case. Our interpretation of this negative relation between equity returns and unanticipated inflation is that the latter generates expectations of tighter monetary policy and thus both higher interest rates and sluggish economic activity.[18]

It is well known that equity returns follow a strong political cycle. For example, during the 1953–80 period equity returns averaged 3½% in the 2 years following presidential elections, but 20% in the 2 years leading up to the elections. Because the political cycle is so readily predictable, such differences in returns must certainly be attributable to other factors which, it just happens, have been correlated with the business cycle in the past but might well not be in the future. Likely candidates for these other factors are the interest rate and business cycles as reflected in our change-in-coupon, turnaround, and unanticipated inflation variables. To determine whether our equations have captured the observed political cycle impact, we have computed the annual errors from equation (T2) in table 3.8 and averaged them over the first and second pairs of years of presidential terms. Much to our surprise, the difference in these averages was a full 13%. That is, our equation accounts for only 3% of the 16½%

Table 3.8 **Explanation of Monthly Realized Equity Returns, 1953–80**

Eq.	Constant	One-Month Bill Rate	Unanticipated Inflation	Turnaround Dummy	Change in Coupon Rate[a]		Presidential Term Dummies			$\bar{R}^2$ (SEE)
					Current	Lagged	Year 2	Year 3	Year 4	
(T1)	.0084	1.0	−5.082	.0238	−.189	−.264	—	—	—	.139
	(.0030)		(1.501)	(.0054)	(.086)	(.087)				(.0374)
(T2)	.0081	1.0	−4.948	.0244	−.131	−.155	—	—	—	.140
	(.0030)		(1.502)	(.0053)	(.055)	(.055)				(.0374)
(T3)	.0022	1.0	−3.695	.0264	−.200	−.260	−.0040	.0115	.0088	.153
	(.0048)		(1.564)	(.0055)	(.085)	(.086)	(.0059)	(.0050)	(.0058)	(.0371)
(T4)	.0016	1.0	−3.521	.0271	−.138	−.152	−.0038	.0117	.0094	.156
	(.0048)		(1.566)	(.0055)	(.055)	(.055)	(.0059)	(.0058)	(.0058)	(.0370)

[a]This variable equals $\Delta R20/(.7\ R20 + .04)$ in the odd-numbered equations and $\Delta R20/.06$ in the even-numbered equations.

average difference in average returns between the 2 years preceding presidential elections and the 2 following years.

The last two equations in table 3.8 include political cycle dummy variables that equal one in months which fall in the second/third/fourth year of presidential terms and zero in all other months. As can be seen, their inclusion raises the explanatory power of the equations. Moreover, the hypothesis that the coefficients on the three political-cycle dummy variables are jointly zero can be rejected at the .05 level. Inclusion of these variables does not affect the interest rate coefficients, but it does alter the others by one-half (the turnaround dummy and the constant terms) to a full (unanticipated inflation) standard error.[19]

3.3 Treasury Bill Returns and the Inflation Rate

3.3.1 Theory

Definitionally, the real rate of interest is the nominal interest rate less the inflation rate. If we let r_{t+1} and R_{t+1} be the real and nominal interest rates earned over the holding period t to $t + 1$, respectively, and I_{t+1} be the inflation rate over the same time span, then

$$r_{t+1} \equiv R_{t+1} - I_{t+1} . \tag{5}$$

Taking expectations of both sides of (5) contingent on information available at t, so that expectations are formed rationally, (5) becomes

$$_t r_{t+1} \equiv R_{t+1} - {_t\pi_{t+1}} , \tag{6}$$

where $_t r_{t+1}$ is the real rate expected at time t to exist in period t + 1, $_t\pi_{t+1}$ is the inflation rate expected at time t to exist in period $t + 1$, and (6) utilizes the fact that the expected nominal interest rate is the ex post rate because R_{t+1} is known at time t. In a world where lenders are required to pay an income tax rate τ on their nominal interest receipts and borrowers can deduct τ percent of their nominal interest payments,

$$_t r^a_{t+1} \equiv (1 - \tau)R_{t+1} - {_t\pi_{t+1}} , \tag{6a}$$

where $_t r^a_{t+1}$ is the expected after-tax real short-term rate.

The expected inflation rate is the difference between actual and unanticipated inflation: $_t\pi_{t+1} \equiv I_{t+1}$ − UNINF_{t+1}. With this substitution in (6a), one can obtain

$$I_{t+1} \equiv {_t r^a_{t+1}} + (1 - \tau)R_{t+1} + \text{UNINF}_{t+1} . \tag{7}$$

If the expected after-tax real short-term rate and τ are constants and the unanticipated rate of inflation is white noise, then it is appropriate to regress I_{t+1} on R_{t+1} and a constant. The equation is estimated with inflation as the dependent variable and the interest rate as the independent because the latter is predetermined while the former develops during the period. Unfortunately, a large body of evidence rejects the assumption of a constant real rate (see Garbade and Wachtel 1978; Mishkin 1981 and references cited in the latter), and the Livingston inflation survey data indicate systematic inflation forecast errors. The purposes of our estimation are to provide evidence on the determinants of the real short-term rate and to test for the presence of systematic errors in inflation forecasts.

3.3.2 Problems with the Inflation and Interest Rate Data

Fama (1975) regressed inflation on the bill rate on data from the January 1953–July 1971 period. He ruled out the data from World War II and its aftermath owing both to the low quality of the CPI prior to 1953 and to the Federal Reserve's pegging of nominal interest rates. Given constant nominal rates and highly variable inflation, the real bill rate varied widely. Our earlier examination of the 1926–39 period suggests that there, too, nominal bill rates were relatively stable (near zero in the 1930s) and real bill rates relatively volatile. Thus we also restrict ourselves to the post-1952 data.

Fama did not extend his analysis beyond July 1971 because the CPI was contaminated beginning in August 1971 by the Nixon price controls. Because "true" inflation is relevant to the nominal bill rate, regressions of recorded inflation on the nominal bill rate may give misleading results when true and recorded inflation rates differ. Subsequently, many investigators, including Fama, have proceeded to analyze data from the control period with no adjustments. In order to utilize post-July 1971 data in our tests, we include a proxy for the difference between recorded and true inflation in our regressions. In constructing this proxy, we utilize the results of Blinder and Newton (1981). More specifically, we use the change in their Model 1 measure of the impact of the controls on the nonfood, nonenergy consumer price index as our proxy for the difference between recorded and true inflation.[20] Their results suggest that the controls reduced the price *level* by 3 percentage points by early 1974, a reduction which was completely offset when the controls were lifted in 1974.

A more general problem with the consumer price index is the treatment of housing costs (especially mortgage interest) in the construction of the index (see Blinder 1980; Dougherty and Van Order 1982). To circumvent this problem, the inflation rate employed in this paper is the consumer price index net of the shelter component. Such an adjustment is particularly important in analyzing data after 1978.

A final possible data problem follows from a phenomenon documented by Cook (1981). He notes that in 1973 and 1974 short-term bill rates became far "out of line" relative to short-term rates on large CDs, commercial paper, and bankers acceptances. During this period market interest rates rose sharply relative to ceiling-constrained yields on deposits. According to Cook, the bill market was segmented from markets for private short-term securities. Because only bills were available in smaller denominations, many households were able to shift deposit funds only into bills. Corporations did not have sufficient bill holdings to arbitrage between the bill and private security markets (they drew their holdings down to zero in 1974), and commercial banks and municipalities had nonyield reasons for maintaining bill holdings. Thus bill rates fell relative to other yields. As a result, expected inflation was not fully reflected in bill rates. In fact, the enormous disparity between private and Treasury short-term yields in 1974 was the driving force behind the creation of the money market fund, an entity that, in the absence of other government regulations, should prevent such disparities from recurring.[21]

During the 156-month 1965–77 period, the spread between one-month prime CDs and one-month Treasury bills was generally within the 30–80 basis point range.[22] Two major exceptions occurred. During the 20 months from April 1969 to November 1970, the spread exceeded 90 basis points in 17 months and was at a maximum of 189 basis points in July 1969. During the 24 months from April 1973 to March 1975, the spread exceeded 90 basis points in 23 months, the maximum being 431 basis points in July 1974. In the 4 years prior to April 1969, the spread was above 80 basis points in only 4 of 48 months and never exceeded 110 basis points. In the 28 months between November 1970 and April 1973, the spread exceeded 81 basis points only once (85 basis points in July 1972). Finally, in the 39 months between April 1975 and June 1978, the spread never exceeded 90 basis points.

In the empirical estimates, then, we specify the inflation rate as the CPI net of shelter, the price control variable CONT is included in regressions using data from the August 1971–December 1974 period, and both the observed one-month Treasury bill rate and an adjusted rate that moves with the CD rate when the bill rate is out of line are utilized as regressors.

3.3.3 The Estimates

Table 3.9 contains the regression coefficients (and their standard errors, below them in parentheses), the coefficient of determination (and the equation standard error, under it in parentheses), and Durbin-Watson ratio for equations explaining the rate of change in the CPI net of shelter over the January 1953–December 1980 span.[23] In the first two equations, it is assumed that the real after-tax bill rate is either a constant or a linear function of the nominal after-tax bill rate and unanticipated inflation is white noise. As can be seen, the bill rate coefficient is significantly above unity. This result is similar to that obtained by Fama and Gibbons (1981, table 1) in their study of data from the 1953–77 period.

Table 3.9 **Regressions of the Inflation Rate on the Treasury Bill Rate, 1953–80**

Eq.	Constant	Bill Rate[a]	Price Controls Variable	Capacity Util. − .834	Unanticipated Inflation	R^2 (SEE)	Durbin-Watson
(T1)	−.00120	1.220	—	—	—	.484	1.47
	(.00029)	(.069)				(.00260)	
(T2)	−.00109	1.190	.539	—	—	.495	1.50
	(.00029)	(.069)	(.194)			(.00258)	
(T3)	−.00099	.920	.231	—	.744	.545	1.61
	(.00028)	(.080)	(.191)		(.124)	(.00245)	
(T4)	−.00095	.857	.215	−.00909	.879	.555	1.64
	(.00027)	(.075)	(.190)	(.00295)	(.123)	(.00243)	
(T5)	−.00133	1.0	.222	−.00862	.753	.158	1.64
	(.00018)		(.190)	(.00295)	(.104)	(.00244)	
(T6)	−.00082	.863	1.0	−.00889	.744	.504	1.58
	(.00027)	(.076)		(.00302)	(.121)	(.00249)	
(T7)	−.00090	.846	.029	−.00933	.782	.559	1.63
	(.00026)	(.073)	(.188)	(.00293)	(.126)	(.00241)	

[a]Except eq. (T7) where adjusted bill rate series is used. See the text for the adjustment.

Because tax rates cannot be negative, this estimate implies that the after-tax real bill rate is negatively related to expected inflation (and thus to the after-tax nominal rate).[24] To illustrate, if ${}_tr^a_{t+1} = \alpha - \beta_t\pi_{t+1}$, then the use of (6a) and the inflation identity (inflation is the sum of its expected and unexpected components) yields

$$(8) \qquad I_{t+1} = -\frac{\alpha}{1-\beta} + \frac{1-\tau}{1-\beta} R_{t+1} + \mathrm{UNINF}_{t+1}.$$

The coefficient on the nominal rate will be greater than unity if $\beta > \tau$.[25] A negative relation between real after-tax debt rates and expected inflation is hardly surprising when the use of historic depreciation and FIFO inventory accounting erodes after-tax real earnings of firms during periods of rising inflation. Because firms are unable to pay constant real after-tax returns to debtors and shareholders in the aggregate, the returns to each would be expected to decline (Hendershott 1981, pp. 913–14).

Examination of the residuals from equation (T2) reveals that they tend to be negative in the 1950s and 1960s and positive in the 1970s. That is, the equation overpredicts inflation in the early years and underpredicts it later. Two possible explanations come to mind. First, the real bill rate may have fallen between the 1960s and 1970s by even more than is captured by the high coefficient on the bill rate and the increase in this rate. If real interest rates are positively correlated with real economic activity, then the relatively sluggish activity in the 1970s would suggest a decline in the real rate.[26]

Second, possibly more of the higher inflation in the 1970s was unanticipated than was the case in the 1950s and 1960s. Comparison of actual 6-month inflation rates with the forecasts computed from the Livingston survey data suggests that this was the case (see Appendix C). Four periods of prolonged unanticipated inflation (four consecutive large 6-month forecasting errors) occurred: the four surveys from June 1956 to December 1957, January 1969 to June 1970, January 1973 to June 1974, and June 1978 to December 1979. Not only did two of these come during the shorter period of large positive residuals, but the average degree of unanticipated inflation was 4½% (at an annual rate) in these two compared to 2½% for the earlier episodes.

Equation (T3) is the result of including a proxy for unanticipated inflation. Of course, if the real bill rate were a constant and the proxy for unanticipated inflation were perfect, then we would be estimating an identity whose usefulness could be easily questioned. What is being tested in equation (T3) is whether an unanticipated inflation variable based on the Livingston survey data improves on the assumption of white noise. The proxy enters with the anticipated positive sign and yields a marked improvement in explanatory power. Moreover, the coefficient on the bill rate is lowered below unity, although not significantly so.

Equation (T3) is consistent with the joint hypotheses that the real Treasury bill rate was constant during the 1953–80 period (at a 1.2% annual rate) and that the Livingston survey data are slightly high estimates of unanticipated inflation.

In equation (T4) we test the hypothesis that real bill rates are related to real economic activity. As a proxy for real activity, we follow Carlson (1979) and Hendershott and Hu (1981) in using the Federal Reserve's capacity utilization rate for manufacturing. Because this rate is available only quarterly, we assign this value to the middle month of the quarter and interpolate linearly between mid-quarter months. This series, lagged one month and divided by 100, less its mean value over the 1953–80 period of 0.834 is the regressor. This variable enters with the expected negative sign and has a t-ratio of 3.[27] The coefficient on unanticipated inflation rises to within a standard error of unity and that on the bill rate falls to nearly two standard errors below unity.[28]

Fama and Gibbons (1981), among others, have provided evidence that expected real bill returns behave like random walks. If this is true of real bill returns even after allowing for their positive relationship with real economic activity, then the nominal bill rate is correlated with the error term and thus its estimated coefficient is biased downward. Equation (T5) provides estimates of the other coefficients when that on the bill rate is arbitrarily constrained to unity. The standard error of the equation rises ever so slightly, and the coefficient on unanticipated inflation falls to 0.75. The adjusted R^2 indicates that one-sixth of the variation in inflation after allowing for variations in the bill rate is explained by variations in unanticipated inflation and capacity utilization.

To this point, the coefficient on the price controls variable has not been discussed. In equation (T2), the coefficient is statistically different from both its maximum plausible value of unity and its minimum plausible value of zero. In subsequent equations, the coefficient is about 0.2 or only one standard error from zero. Although the controls variable is nonzero in only the August 1971–December 1974 period, its coefficient could affect the coefficients on the other variables because all variables move sharply in this period. To test this sensitivity, equation (T4) was rerun with the controls coefficient arbitrarily constrained to unity. Equation (T6) indicates that only the coefficient on unanticipated inflation is affected, declining to 0.75.

Our last experiment tests an adjusted bill rate variable which takes into account the fact that bill rates were out of line relative to private open market rates during much of the April 1969–March 1975 period. In April 1975, the first month after bill rates returned to the normal relationship with private rates, the one-month bill rate was 0.004347. The bill rate was almost precisely the same in November 1968, shortly before it got out of line. In this month, the one-month CD rate exceeded the bill rate by

0.00047. The adjusted bill rate series is defined as the CD rate less 0.00047 during the November 1968–March 1975 period and the bill rate otherwise. This adjusted series replaces the observed bill rate in equation (T7). Relative to equation (T4), the coefficients on the price controls and unanticipated inflation variables decline by a standard error, and the explanatory power of the equation rises slightly.

3.3.4 Summary

Three findings should be emphasized. First, the existence of price controls and out-of-line bill rates in the early and middle 1970s do not have an important impact on the estimates. Inclusion of the price controls variable or adjustment of the bill rate improve the explanation of inflation slightly, but the values of the important regression coefficients are largely unaffected.

Second, the real bill rate is shown to be systematically related to the level of real activity as measured by the capacity utilization rate. With the coefficient of the latter equal to -0.009, the real bill rate is 2½ percentage points higher (at an annual rate) when the utilization rate is 90% than when it is 70%.

Third, the estimated responses of actual inflation to both expected inflation (as reflected in the bill rate) and unanticipated inflation (based on the Livingston survey data) are close to unity. The bill rate coefficient point estimate is 0.85, while that of the unanticipated inflation varies between 0.74 and 0.88. Although the lowest of these coefficients is two standard errors below unity, we do not emphasize this because there is reason to believe that the coefficients may be biased downward. Unfortunately, the tax rate of the representative investor cannot necessarily be inferred from the bill rate coefficient. For example, an estimate of unity implies a zero tax rate if the real bill rate is independent of the expected inflation rate, but a positive tax rate if the real bill rate is negatively related to expected inflation, a relationship that would be reflected in the estimated bill rate coefficient. The significance and empirical importance of the unanticipated inflation measure suggest that the Livingston survey data, which indicate a significant underestimate of 6-month inflation throughout much of the 1969–80 period, may well have accurately reflected the expectations of market participants. This underestimate of expected inflation explains why nominal bill rates failed to move one for one with actual inflation during the 1952–80 period.

3.4 The Determinants of Unanticipated Changes in Treasury Coupon Rates

In section 3.2, ex post returns on corporate bonds and equities were shown to be strongly influenced by unanticipated changes in long-term new-issue Treasury coupons (or by total changes which were shown to be largely unanticipated). The last stage of our study is an investigation of the determinants of these unanticipated changes.[29] We begin with the analytical framework and then report some equation estimates.

3.4.1 Framework

Unanticipated changes in long-term Treasury rates are caused by changes in long-run expected inflation, which are unanticipated by definition, and unanticipated changes in the long-term real rates. Of course, neither of these is observable. Thus the problem is to specify proxies for expected inflation and the expected real rate and, for the latter, to distinguish between anticipated and unanticipated changes.

The results of sections 3.2 and 3.3 give us some guidance here. From the Livingston survey, we have estimates of expected short-run inflation. While the validity of this survey data is questioned by some, the empirical significance of the measure of unanticipated inflation based on these data in both the equity-return and inflation regressions suggests that the data have empirical content. It seems reasonable that long-run inflationary expectations would be revised upward in response to unanticipated short-run inflation.

The inflation equations also implied that real Treasury bill rates are related positively to the capacity utilization rate. Short-run changes in this rate, in turn, must be closely correlated with the growth rate of industrial production. As a consequence, it is reasonable to hypothesize that unanticipated changes in long-term rates are positively correlated with deviations between actual and expected growth rates in industrial production. Fortunately, the Livingston survey also contains forecasts of industrial production 6 months ahead.

Because the Livingston survey data are available only semiannually (June and December), the analysis of unanticipated changes in Treasury coupon rates is conducted in a 6-month time frame. That is, changes from December of one year to June of the next, from that June to the next December, and so on, are the dependent variable in the analysis (the specific data are discussed and listed in Appendix C). We denote the change from $t - 1$ to t as $UN\Delta_t$. This change is hypothesized to depend on unanticipated industrial production growth, UNIP_t and unanticipated inflation, UNINF_t, between $t - 1$ and t. These variables are defined more precisely as

$$\text{UNIP}_t = [IP_t - E_{t-1}(IP_t)]/IP_{t-1}$$
$$\text{UNIF}_t = I_t - E_{t-1}(I_t)\,,$$

where IP is the level of industrial production, I is the inflation rate (the subscript t denotes inflation from $t - 1$ to t), and E is the expectations operator.

Policy surprises must also be accounted for because they may provide information beyond that incorporated in the above defined variables. This would likely be true to the extent that policy surprises affect prices and real income with a lag; if the full impact occurred instantaneously, it would be reflected in the unanticipated inflation and industrial production growth variables. The most obvious surprise in the 1955–80 period was the imposition and removal of price controls in the early 1970s. To proxy this surprise, we specify a controls dummy variable that assumes the value -1 in the second half of 1971 when the controls were imposed, $+1$ in the first half of 1974 when the controls were removed, and zero in all other periods. To the extent that the imposition and removal of controls, respectively, lowered and raised expected long-run inflation, this variable, PCDUM, should have a positive impact on the change in coupon rate.

The fiscal surprise variable employed is that computed by von Furstenberg (1981). This variable is defined as the difference between the actual and "normal" surpluses of federal, state, and local governments, divided by net national product. The normal surplus takes into account not only the stage of the business cycle but also regular (forecastable) discretionary policy actions taken over the course of the business cycle (regular tax cuts during recessions, for example). This variable is denoted by FSUR. The variable exceeds 1½% in absolute value in only three periods: 1960, mid-1966–mid-1968 (the Vietnam buildup), and the second quarter of 1975 (the extraordinary tax rebate). A positive fiscal surprise (unusually large surplus) would be expected to lower interest rates. The decline would be relatively minor if the surprise does not lead to a revision in the "fiscal policy" rule. Von Furstenberg argues persuasively that this was the case in the 1955–78 period.

The monetary surprise variable tested is the difference between the rate of growth in the adjusted monetary base computed by the Federal Reserve Bank of St. Louis and the growth rate in recent periods (say the previous 2 years). The impact of this variable on interest rates is unclear. Unanticipated monetary growth would tend to depress real rates (Milton Friedman's "liquidity effect") but would lead to an upward revision in the inflation premia.[30] Because the estimated coefficient on variance of this variable never had a *t*-ratio greater than one or an estimated impact greater than a few basis points, equation estimates with this variable are not reported below.

We would expect that the coupon rate would be linearly related to the unanticipated inflation and price control variables as constructed. Because the unanticipated industrial production and fiscal surprise variables are real ratios, we would expect them to affect the percentage change in the new-issue coupon rate. To reflect these considerations, the unanticipated change in the coupon rate, unanticipated inflation, and the price controls variable have all been deflated by the lagged value of the 20-year Treasury coupon rate. Thus the estimated equations are of the form:

$$(9)\quad UN\Delta/R20_{-1} = \theta_0 + \theta_1\text{UNIP} + \theta_2\text{UNINF}/R20_{-1} - \theta_3\text{FSUR} + \theta_4\text{PCDUM}/R20_{-1},$$

where $\theta_0 \sim 0$ and $\theta_i > 0$ for $i > 0$.

3.4.2 The Estimates

The first equation in table 3.10 is estimated over the 1955–78 period, the span for which von Furstenberg calculated his fiscal surprise variable. All variables enter significantly with the expected signs, the constant term is within a standard error of zero, and the equation explains a third of the variance in the dependent variable. The sources of the cumulated 6 percentage point rise in the new issue coupon rate over the 1955–78 period are unanticipated 6-month inflation and industrial production growth; both averaged 1.3 percentage points per period in this span. Multiplication of 1.3 by 48 semiannual periods and the relevant regression coefficient yields 3.3 percentage points for the cumulative effect of unanticipated inflation. To obtain the impact of unanticipated industrial production growth, we multiply 1.3 by 48, the regression coefficient (.0082), and the mean value of the 20-year Treasury coupon in this period, 5.4. The result is 2.8 percentage points. A single 4½ percentage point inflation error, which occurred during 1973–74 and again in 1979, is accompanied by a quarter of a percentage point rise in the coupon rate. The production growth forecasting errors exceeded ±0.06 in six semiannual periods between 1955 and 1978 but were never larger than ±0.092; the 0.0082 coefficient implies that a 0.08 underforecast of industrial production growth is associated with a two-thirds percentage point increase in the new issue coupon when it is at the 10% level. A relatively

Table 3.10 Determination of Semiannual Percentage Unanticipated Changes in the New Issue Coupon Rate[a]

Period	Constant	Unanticipated Individual Product Growth	Unanticipated Inflation	Fiscal Surprise	Price Controls Dummy	$\bar{R}^2$ (SEE)
1955–78	−.0107	.0082	.0535	−.0129	.660	.340
	(.0109)	(.0020)	(.0281)	(.0066)	(.268)	(.0519)
1955–80	−.0074	.0093	.0578	−.0128	.646	.331
	(.0115)	(.0021)	(.0292)	(.0071)	(.287)	(.0557)

[a]The dependent variable, unanticipated inflation, and the price controls dummy are deflated by the beginning-of-period, 20-year, new-issue coupon rate.

large negative fiscal surprise, such as the 2½ percentage point surprise during the mid-1966–mid-1968 Vietnam buildup, is accompanied by a 15 basis point per period rise in the coupon rate. Finally, the imposition of price controls appears to have lowered long-run inflation expectations by nearly two-thirds of a percentage point.

The second equation in table 3.10 contains estimates for the full 1955–80 period. In this equation the fiscal surprise variable was arbitrarily set equal to zero (the variable was 0.404 in the fourth quarter of 1978 and averaged −0.187 during the 1955–78 period). Beause there were not any obvious surprises in the last 2 years of the Carter administration, this is probably a reasonable approximation. The estimated coefficients are close to those of the first equation with the exception of the response to unanticipated growth which rises by half a standard error. The actual and predicted percentage changes from this equation are plotted in figure 3.2. As can be seen, the equation seems to underpredict a number of large changes (except those associated with price controls) but does capture major swings in the new issue coupon (except possibly the most recent one).

With the fiscal surprise variable still maintained at zero, our equation significantly overpredicts the level of the Treasury coupon rate in 1981 and 1982, even allowing for the sharp decline in late 1982. This is to be expected for two reasons. First, a substantial fiscal surprise has undoubtedly occurred. While taxes are normally cut during recessions and the 1982 full employment deficit is not large by historical standards, the combination of the July 1983 tax cut, the indexation of taxes in future years, and the difficulties of controlling many expenditures leads to large "out year" full employment deficits. This "permanent" surprise could have had a quite large impact on interest rates. Second, the sharp 1981 cut in the taxation of returns from business capital would be expected to raise real interest rates by a percentage point or two (Hendershott and Shilling 1982).

3.5 Summary

This study began with an examination of data for the 1926–80 period on returns earned on one-month Treasury bills, long-term Treasury and corporate bonds, and corporate equities. Relationships among the returns and between them and inflation and the business cycle were identified. We then turned to econometric investigations of the relationships between ex post monthly returns on corporate securities and bill rates and other variables, principally the unanticipated change in the coupon on new-issue Treasury bonds. We concluded with an investigation of the determinants of the bill rate and the unanticipated change in long-term Treasury coupon rates.

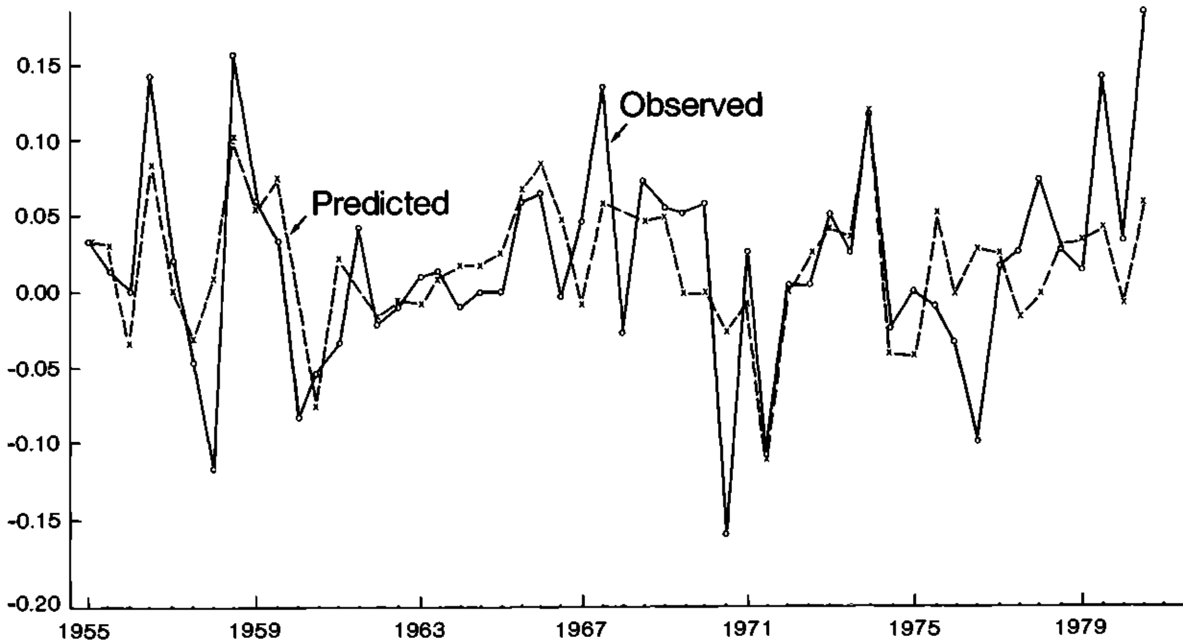

Fig. 3.2 Observed and predicted semiannual percentage unanticipated changes in the twenty-year new-issue Treasury bond rate.

The most general theme of the econometric work is the usefulness of the Livingston survey data in explaining financial returns. Unanticipated inflation, defined as the difference between short-run observed inflation and the Livingston forecast, enters the equity-returns, inflation-rate, and change-in-new-issue-coupon equations significantly. (When unanticipated inflation is not included as a regressor in the inflation equation, the estimates imply that real [bill] interest rates are negatively related to expected inflation; when unanticipated inflation is included this negative relationship does not appear to exist.) In addition, changes in new-issue coupon rates are positively related to unanticipated growth in industrial production, defined as the difference between observed growth and the Livingston forecast.

The latter result is part of a secondary theme, a positive relationship between real interest rates or returns and real economic activity. Ex post equity returns ("the market") are strongly related to expectations of future economic activity. In every business cycle since at least 1926, the market has risen sharply around cycle troughs (the last half or 6 months, whichever is shorter, of recessions and first 6 months of expansions); other things being equal, equity returns are 34 percentage points higher during this key year of turnaround in expectations than these returns are at other times. In addition, unanticipated inflation, which appears to lead to expectations of lower real economic activity, depresses equity values (by as much as 22% in 1973–74 and 1979), other things being equal. The investigation of new-issue debt yields lends supporting results. The real Treasury bill rate is positively related to the capacity utilization rate with the real rate being 2½ percentage points higher when utilization is at 90% than when it is at 70%. Because more rapid growth in industrial production leads to higher capacity utilization, the relationship between changes in new issue rates on long-term Treasuries and this growth is implicitly a relationship between the level of Treasury bond rates and capacity utilization.

Unanticipated changes in new Treasury coupon rates (and 88% of monthly changes during the 1953–77 period were unanticipated) are the dominant determinant of ex post monthly coporate bond returns and also strongly influence equity returns. Regarding the latter, a 2½ percentage point increase in new-issue Treasury coupon rates is estimated to lower the market by 10%. More generally, for the 1961–80 period the data are consistent with the Modigliani-Cohn valuation error model and a dividend tax rate of about 0.4. Finally, a third of semiannual percentage unanticipated changes in new-issue coupon rates over the 1955–80 period can be explained by unanticipated 6-month inflation and industrial production growth, fiscal policy "surprises," and the imposition and removal of price controls in the early 1970s.

The analysis of the present study can usefully be extended in two ways. First, a switch to a semiannual data base for all parts of the empirical work is called for in order to utilize the Livingston survey data more appropriately. This switch might also allow some differentiation in the effects of real and purely nominal unanticipated bond rate changes on equity returns. Our analysis was not able to distinguish between Modigliani-Cohn irrationality (there is no need to differentiate between changes in real rates and in inflationary premia because investors only care about their sum) and rationality (with much of nominal rate changes being real changes) because it is nearly impossible to identify inflationary premia in long-term bond rates on a monthly basis. Second, the stability of the estimated relationships over time should be tested. It would, of course, be useful to know if the relationships have been altered by the change in Federal Reserve operating procedures and the resulting increased volatility in financial markets since October 1979. Preliminary examination of the movement in long-term Treasury coupons indicates that a change has likely occurred.

Appendix A
Granger Causality Tests

The purpose of this Appendix is to investigate the information content of past returns on bonds (equities) in determining equity (bond) yields after accounting for past yields on equities (bonds). The role of the inflation rate is examined in this context both by introducing it as a determining factor for asset yields and by comparing the behavior of nominal and real asset yields.

The statistical tool we use here corresponds to a statistical test for exogeneity commonly known as the Granger causality test. It should be emphasized that the word 'causality' is used here only in the restrictive sense of predictability. More specifically, we say that a time series X_t Granger causes another time series Y_t if we are able to better predict Y_t in the sense of a lower mean squared prediction error by using the past values of both X_t and Y_t than by employing only the past values of Y_t.

Specifying the predictor to be a linear one, the test involves regressing Y_t on lagged Y_t's and X_t's, that is,

$$Y_t = \sum_{i=1}^{k_1} \alpha_i Y_{t-1} + \sum_{i=1}^{k_2} \beta_i X_{t-i}. \tag{A1}$$

If the parameters β_i, $i = 1, \ldots, k_2$, are significantly different from zero, then X_t Granger causes or is informative in the prediction of Y_t. In order to test the predictive content of Y_t in determining X_t, the roles of Y_t and X_t in (A1) are reversed.

If, contrary to (A1), the relevant information set contains variables other than X_t and Y_t, then the above regression test may show spurious causality between X_t and Y_t if the other variable leads both X_t and Y_t. Given the results of the previous section, it is therefore highly probable that a test of the predictive relationship between corporate bonds and stocks will reveal Granger causality; the causality being the result of shocks that are common to both stocks and bonds.

In our tests, we specify $k_1 = k_2 = 6$. It is felt that 6 months is long enough to reflect any price adjustments. A constant term and time trend are added to (A1) in the estimation to capture the presence of deterministic components.

In table 3.A.1 we report the results of the tests of the bivariate relationships between equity and debt returns. The overlapping sample periods reported are the entire sample 1926–80, the pre–Treasury

Table 3.A.1 **Granger Causality Tests**

$$Y_t = c + \sum_{i=1}^{6} \alpha_i Y_{t-i} + \sum_{i=1}^{6} \beta_i X_{t-i} + \delta t$$

Variables		Sample	$F_{m,n}$-Statistic:		
Y	X	Period	Nominal	Real	m, n
CS	CB	1926–	3.130*	4.172*	6,640
CB	CS	1980	1.273	1.653	6,640
CS	CB	1926–	2.596	2.444	6,304
CB	CS	1952	6.199*	6.276*	6,304
CS	CB	1932–	1.413	1.852	6,220
CB	CS	1952	.913	1.093	6,220
CS	CB	1953–	2.950*	3.512*	6,316
CB	CS	1980	3.452*	3.260*	6,316
CS	GB	1926–	2.203	3.104*	6,640
GB	CS	1980	1.267	.686	6,640
CS	GB	1926–	1.131	1.038	6,304
GB	CS	1952	.443	.630	6,304
CS	GB	1933–	.215	.691	6,220
GB	CS	1952	.491	.328	6,220
CS	GB	1953–	3.337*	3.808*	6,316
GB	CS	1980	2.478	2.113	6,316
CS	TB	1926–	1.871	2.414	6,640
TB	CS	1980	2.427	1.530	6,640
CS	TB	1926–	.945	1.352	6,304
TB	CS	1952	.771	1.085	6,304
CS	TB	1933–	1.138	2.493	6,220
TB	CS	1952	.954	1.808	6,220
CS	TB	1953–	1.398	2.187	6,316
TB	CS	1980	1.716	1.239	6,316

Note: The following notations are used: CS for common stocks, CB for corporate bonds, TB for Treasury bills. X and Y variables refer to the same variables in eq. (A1) in the text.
*Significant at the 5% level.

Accord period 1926–52, the pre–Treasury Accord period after the Great Depression 1933–52, and the post-Accord span of 1953–80. Reported are the F-statistics for tests of the null hypothesis that all the β's in (A1) are zero. The tests are performed for both the nominal and real rates of return.

With one exception, returns on government bonds or bills contain no informative content in the prediction of equity returns. The reverse is also supported. The sole exception is the informativeness of government bonds in predicting stock returns during the post-Accord period. As for common stocks and corporate bonds, the latter Granger-caused the former when the whole sample is utilized. However, when subperiods of

Table 3.A.2 Granger Causality Tests with Past Inflation Included

$$Y_t = c + \sum_{i=1}^{6} \alpha_i Y_{t-i} + \sum_{i=1}^{6} \beta_i X_{t-i} + \sum_{i=1}^{6} \gamma_i I_{t-i} + \delta t$$

Variables						
Y	X	Sample Period	$F_{m,n}$-Statistic	m, n	$F_{m,n}$-Statistic	m, n
CS	CB	1926–	1.751	6,634	2.451*	12,634
CB	CS	1980	.542	6,634	.905	12,634
CS	CB	1926–	1.141	6,298	1.872	12,298
CB	CS	1952	.884	6,298	3.534*	12,298
CS	CB	1933–	1.845	6,214	1.646	12,214
CB	CS	1952	1.704	6,214	1.317	12,214
CS	CB	1953–	1.573	6,310	2.277*	12,310
CB	CS	1980	1.548	6,310	2.518*	12,310
CS	GB	1926–	1.685	6,634	1.784	12,634
GB	CS	1980	.465	6,634	1.440	12,634
CS	GB	1926–	.999	6,298	.972	12,298
GB	CS	1952	.431	6,298	.597	12,298
CS	GB	1933–	2.206	6,214	1.690	12,214
GB	CS	1952	.887	6,214	.919	12,214
CS	GB	1953–	2.277	6,310	1.854	12,310
GB	CS	1980	3.465*	6,310	2.630*	12,310
CS	TB	1926–	1.576	6,634	1.895	12,634
TB	CS	1980	.303	6,634	.781	12,634
CS	TB	1926–	.935	6,298	1.033	12,298
TB	CS	1952	.445	6,298	.442	12,298
CS	TB	1933–	1.872	6,214	1.046	12,214
TB	CS	1952	1.573	6,214	1.036	12,214
CS	TB	1953–	1.367	6,310	2.364*	12,214
TB	CS	1980	1.634	6,310	2.071	12,310

Note: The following notations are used: CS for common stocks, CB for corporate bonds, TB for Treasury bills, and I is the inflation rate. X and Y variables refer to the same variables in eq. (A1) in the text.

*Significant at the 5% level.

the entire sample are examined, the causality is in the opposite direction with corporate bonds leading stocks for the 1926–52 period. When the Depression years are excluded from the 1926–52 period, no causality in either direction was observed. Finally, both equity and corporate bonds appear to be valuable in predicting one another in the post-Accord period. These observations are virtually unchanged whether real or nominal returns are used.

In 3.A.2, we reexamine the results of table A1 by focusing on nominal returns but with past inflation rates (I_{t-i}) added as a possible additional source of information. The results indicate that past inflation rates by themselves do not contain information content. Moreover, the same conclusions drawn from table 3.A.1 with respect to common stocks and corporate bonds can be drawn from table 3.A.2 when the null hypothesis tested is that both past X_t and I_t have no informative content in predicting Y_t once one has accounted for past values of Y_t. Also, as in table A1, in general no distinct causal patterns emerges when government bonds or bills are used in place of corporate bonds.

To summarize, the results indicate the usefulness, in the post-Accord period, of past corporate bonds (stock) returns in predicting current corporate stock (bond) returns even after allowing for the presence of past corporate stock (bond) returns. This result is observed when either nominal or real returns are used as well as when past inflation rates are added as additional sources of information. As for government bonds or bills when examined with stocks, no consistent lead or lag relationships were uncovered. It may very well be that the Granger causalities observed for corporate bonds and stocks are due to variables other than the inflation rate that affect both the variables being examined.

Appendix B
The McCulloch Data

Our analysis of ex post bond and equity returns employed changes in the long-term, new-issue-equivalent Treasury bond rate and the unanticipated change in this rate as regressors. Both of these variables have been computed by Huston McCulloch (1975, 1977) who developed a technique of curve-fitting the term structure of interest rates from security prices so as to determine implicit forward interest rates as precisely as possible. At each point in time for which Treasury security prices are available, a discount function is estimated, using a cubic spline tax-adjusted technique, to give the value at these points of a promise to repay a dollar at alternative future dates. Before-tax equivalent instantaneous forward rates, single payment yields, and par bond yields were calculated from the parameters of the spline discount curve for maturities sufficiently close to allow linear interpolation to all desired intermediate points. The tax adjustment was especially important in the late 1960s and early 1970s when all long-term Treasury bonds were selling at substantial discounts owing to effective restrictions against new issues between 1965 and 1973 and the sharp rise in interest rates after the mid-1960s (see Cook and Hendershott 1978).

Except for tax-exempt and selected flower bonds (those whose prices were determined by the flower bond characteristic), virtually all U.S. Treasury bills, notes, and bonds have been analyzed monthly since January 1974 (McCulloch updates the file a number of times per year). The data presented in columns 4 and 3 of table 3.A.3 are the level and change in the new-issue-equivalent semiannual coupon yields on 20-year Treasury bonds or on the longest possible maturity computable with McCulloch's technique. During the 1952–81 period the longest maturity was below 19 years only in the 1970–72 period.

Column 2 of table 3.A.3 contains McCulloch's measure of unanticipated monthly changes in the longest-term Treasury rates, ignoring liquidity premia (McCulloch 1977, app. 3). This is the difference between the one-month forward par bond yield and the observed corresponding spot par bond yield one month later.

In our analysis of semiannual changes in long-term interest rates, we have updated McCulloch's data on a semiannual basis. Here, we compute the difference between 6-month forward par bond yields (b^*) and the observed corresponding spot par bond yield 6 months hence ($R20_{+1}$). The unanticipated change ($UN\Delta$) is thus $UN\Delta = R20_{+1} - b^*$, where b^* is the semiannual coupon rate that will make the value of a bond in 6 months, evaluated at the current term structure, just equal to par, discounted to the present using the current term structure. To make the calculations, we use as inputs McCulloch's semiannual coupons (y) on 6-month (0.5 years) and 20½-year bonds and continuous single-point par discount yields (d) on the same maturity bonds. First, the semiannual coupons are converted to continuous equivalents

$$c = 2 \log_e(1 + y/2)$$

for maturities 0.5 and 20.5.

Second, the continuous forward par bond yield is computed as

$$b = \frac{e^{-0.5d}0.5 - e^{-20.5d}20.5}{[1 - e^{-20.5d}20.5]/c_{20.5} - [1 - e^{-0.5d}0.5]/c_{0.5}}.$$

Finally, this continuous yield is converted to a semiannual coupon equivalent: $b^* = 2(e^{b/2} - 1)$.

Unanticipated changes for the first half of 1977 (December 1976—

average of beginning and end of month values—to June 1977) through the first half of 1982 are listed in Appendix C.

The percentage changes in yields employed in the stock return equations are the changes ($\Delta R20$ or $UN\Delta$) divided by the end of period value of $R20$.

Table 3.A.3 **McCulloch's Data**

Date	$U\Delta R20$	$\Delta R20$	$R20$	Date	$U\Delta R20$	$\Delta R20$	$R20$
5212	—	—	2.76	5604	.056	.13	3.02
5301	.072	.08	2.84	5605	.098	.05	3.07
5302	.009	.01	2.85	5606	−.087	−.12	2.95
5303	.080	.08	2.93	5607	−.037	.01	2.96
5304	.020	.03	2.96	5608	.105	.15	3.11
5305	.162	.18	3.14	5609	.120	.17	3.28
5306	.029	.11	3.25	5610	−.074	−.08	3.20
5307	−.074	−.19	3.06	5611	.131	.08	3.28
5308	.081	.05	3.11	5612	.066	.09	3.37
5309	.012	.05	3.16	5701	.153	.22	3.59
5310	−.154	−.21	2.95	5702	−.268	−.43	3.16
5311	−.043	.04	2.99	5703	.045	.14	3.30
5312	.004	.04	3.03	5704	−.004	−.06	3.24
5401	−.137	−.18	2.85	5705	.137	.13	3.37
5402	−.042	−.03	2.82	5706	.030	.07	3.44
5403	−.177	−.21	2.61	5707	.094	.09	3.53
5404	−.013	.02	2.63	5708	.019	−.01	3.52
5405	−.047	−.03	2.60	5709	.022	.02	3.54
5406	.054	.08	2.68	5710	.058	.15	3.69
5407	−.118	−.12	2.56	5711	.057	.06	3.75
5408	−.051	−.03	2.53	5712	−.136	−.04	3.71
5409	.010	.02	2.55	5801	−.463	−.46	3.25
5410	.005	.00	2.55	5802	.050	.05	3.30
5411	.022	.05	2.60	5803	−.091	−.04	3.26
5412	.051	.08	2.68	5804	.000	.01	3.27
5501	−.019	.01	2.69	5805	−.126	−.13	3.14
5502	.125	.13	2.82	5806	−.063	.02	3.16
5503	.052	.05	2.87	5807	.085	.10	3.26
5504	−.038	−.03	2.84	5808	.275	.28	3.54
5505	−.020	.03	2.87	5809	.184	.22	3.76
5506	−.012	−.04	2.83	5810	.070	−.01	3.75
5507	.004	.06	2.89	5811	−.076	−.04	3.71
5508	.056	.10	2.99	5812	−.042	−.01	3.70
5509	.019	−.03	2.96	5901	.095	.14	3.84
5510	−.025	−.03	2.93	5902	.119	.21	4.05
5511	−.036	−.06	2.87	5903	−.005	−.05	4.00
5512	.041	.08	2.95	5904	−.002	.02	4.02
5601	−.051	−.02	2.93	5905	.027	.08	4.10
5602	−.018	−.07	2.86	5906	.031	.02	4.12
5603	.011	.03	2.89	5907	.030	.06	4.18

Table 3.A.3 (continued)

Date	$U\Delta R20$	$\Delta R20$	$R20$	Date	$U\Delta R20$	$\Delta R20$	$R20$
5908	−.035	−.01	4.17	6309	.000	−.01	4.05
5909	.053	.05	4.22	6310	.078	.05	4.10
5910	−.018	.01	4.23	6311	.027	.06	4.16
5911	−.035	−.04	4.19	6312	−.001	.00	4.16
5912	.066	.09	4.28	6401	.025	.07	4.23
6001	.172	.18	4.46	6402	−.025	−.02	4.21
6002	−.064	−.02	4.44	6403	.004	.02	4.23
6003	−.144	−.17	4.27	6404	.029	.04	4.27
6004	−.212	−.18	4.09	6405	−.009	−.02	4.25
6005	.195	.23	4.23	6406	−.049	−.05	4.20
6006	−.110	−.08	4.24	6407	−.017	−.02	4.18
6007	−.224	−.23	4.01	6408	.039	.05	4.23
6008	−.201	−.23	3.78	6409	−.003	.02	4.25
6009	.096	.07	3.85	6410	−.008	−.02	4.23
6010	.002	.03	3.88	6411	−.024	−.02	4.21
6011	−.004	.05	3.93	6412	.014	.03	4.24
6012	.039	.08	4.01	6501	.007	.02	4.26
6101	−.125	−.16	3.85	6502	−.013	−.02	4.24
6102	.078	.09	3.94	6503	.007	.01	4.25
6103	−.125	−.10	3.84	6504	−.002	−.01	4.24
6104	−.016	.03	3.87	6505	−.003	.00	4.24
6105	−.066	−.05	3.82	6506	.004	.02	4.26
6106	−.016	.01	3.83	6507	−.012	−.02	4.24
6107	.151	.12	3.95	6508	.017	.02	4.26
6108	.015	.04	3.99	6509	.036	.04	4.30
6109	.098	.03	4.02	6510	.059	.08	4.38
6110	−.016	−.04	3.98	6511	.005	.02	4.40
6111	−.038	−.04	3.94	6512	.075	.10	4.50
6112	.019	.06	4.00	6601	.097	.10	4.60
6201	.026	.05	4.05	6602	.070	.05	4.65
6202	.010	.05	4.10	6603	.226	.22	4.87
6203	.029	.03	4.13	6604	−.167	−.16	4.71
6204	−.155	−.12	4.01	6605	.034	.07	4.78
6205	−.029	−.02	3.99	6606	.065	.05	4.83
6206	.003	−.01	3.98	6607	.072	.13	4.96
6207	.033	.04	4.02	6608	.012	.00	4.96
6208	.179	.09	4.11	6609	.269	.30	5.26
6209	−.150	−.08	4.03	6610	−.250	−.25	5.01
6210	−.041	−.02	4.01	6611	−.108	−.16	4.85
6211	−.045	−.03	3.98	6612	.123	.16	5.01
6212	−.002	−.02	3.96	6701	−.247	−.30	4.71
6301	−.013	−.04	3.92	6702	−.113	−.13	4.58
6302	.035	.05	3.97	6703	.202	.25	4.83
6303	.011	.08	4.05	6704	−.123	−.16	4.67
6304	.017	.01	4.06	6705	.219	.29	4.96
6305	.027	.04	4.10	6706	.054	.02	4.98
6306	−.031	−.02	4.08	6707	.216	.21	5.19
6307	−.005	.00	4.08	6708	.001	.05	5.24
6308	−.041	−.02	4.06	6709	.084	.06	5.30

Table 3.A.3 (continued)

Date	$U\Delta R20$	$\Delta R20$	$R20$	Date	$U\Delta R20$	$\Delta R20$	$R20$
6710	.045	.09	5.39	7111	−.104	−.03	6.12
6711	.249	.23	5.62	7112	−.051	−.02	6.10
6712	.198	.21	5.83	7201	.061	.01	6.11
6801	−.023	.04	5.87	7202	.325	.29	6.40
6802	−.180	−.19	5.68	7203	−.151	−.10	6.30
6803	.060	.05	5.73	7204	−.061	−.02	6.28
6804	.255	.31	6.04	7205	−.032	−.02	6.26
6805	−.182	−.21	5.83	7206	−.096	−.07	6.19
6806	−.011	.04	5.87	7207	.040	.04	6.23
6807	−.130	−.19	5.68	7208	.123	.12	6.35
6808	−.131	−.15	5.53	7209	.057	.07	6.42
6809	−.016	−.02	5.51	7210	.113	.13	6.55
6810	.146	.19	5.70	7211	−.179	−.15	6.40
6811	.180	.21	5.91	7212	−.127	−.05	6.35
6812	.116	.19	6.10	7301	.047	.04	6.39
6901	.430	.43	6.53	7302	.119	.48	6.87
6902	.109	.08	6.61	7303	−.006	−.02	6.85
6903	−.075	−.04	6.57	7304	−.020	−.02	6.83
6904	−.015	−.02	6.55	7305	−.006	.01	6.84
6905	−.148	−.19	6.36	7306	.164	.15	6.99
6906	.344	.38	6.74	7307	.077	.09	7.08
6907	−.162	−.20	6.54	7308	.443	.41	7.49
6908	−.099	−.08	6.46	7309	−.253	−.19	7.30
6909	−.065	−.08	6.38	7310	−.247	−.26	7.04
6910	.329	.35	6.73	7311	.348	.39	7.43
6911	−.065	−.07	6.66	7312	−.203	−.21	7.22
6912	.276	.31	6.97	7401	.132	.12	7.34
7001	.101	.10	7.07	7402	.097	.10	7.44
7002	−.091	−.13	6.94	7403	.098	.10	7.54
7003	−.387	−.39	6.55	7404	.324	.26	7.80
7004	.147	.40	6.95	7405	.297	.29	8.09
7005	.754	.36	7.31	7406	.002	.03	8.12
7006	.077	.52	7.83	7407	−.075	−.08	8.04
7007	−.298	−.33	7.50	7408	.145	.13	8.17
7008	−.081	−.20	7.30	7409	.226	.22	8.39
7009	.034	.12	7.42	7410	−.075	−.02	8.37
7010	−.226	−.17	7.25	7411	−.304	−.29	8.08
7011	−.033	.04	7.29	7412	−.134	−.07	8.01
7012	−.738	−.85	6.44	7501	−.058	−.01	8.00
7101	−.004	.01	6.45	7502	−.168	−.27	7.73
7102	−.388	−.38	6.07	7503	−.054	−.03	7.70
7103	.181	.20	6.27	7504	.452	.60	8.30
7104	−.396	−.38	5.89	7505	.111	.03	8.33
7105	.285	.16	6.05	7506	−.255	−.11	8.22
7106	.316	.36	6.41	7507	−.053	−.10	8.12
7107	.307	.33	6.74	7508	.106	.16	8.28
7108	.118	.16	6.90	7509	.108	.13	8.41
7109	−.616	−.56	6.34	7510	.180	.24	8.65
7110	−.270	−.19	6.15	7511	−.439	−.44	8.21

Table 3.A.3 (continued)

Date	$U\Delta R20$	$\Delta R20$	$R20$	Date	$U\Delta R20$	$\Delta R20$	$R20$
7512	.163	.21	8.42	7807	—	.11	8.67
7601	−.317	−.32	8.10	7808	—	−.07	8.60
7602	−.056	−.03	8.07	7809	—	−.18	8.42
7603	.006	.03	8.10	7810	—	.22	8.64
7604	−.171	−.16	7.94	7811	—	.26	8.90
7605	.012	.05	7.99	7812	—	−.12	8.78
7606	.160	.19	8.18	7901	—	.21	8.99
7607	−.137	−.12	8.06	7902	—	−.11	8.88
7608	−.017	.00	8.06	7903	—	.22	9.10
7609	−.175	−.15	7.91	7904	—	−.04	9.06
7610	−.082	−.07	7.84	7905	—	.19	9.25
7611	−.065	−.04	7.80	7906	—	−.15	9.10
7612	−.324	−.28	7.52	7907	—	−.26	8.84
7701	−.225	−.26	7.26	7908	—	.15	8.99
7702	.369	.43	7.69	7909	—	.13	9.12
7703	.108	.12	7.81	7910	—	.16	9.28
7704	−.101	−.04	7.77	7911	—	1.13	10.41
7705	−.037	−.02	7.75	7912	—	−.23	10.18
7706	−.064	−.03	7.72	8001	—	.03	10.21
7707	—	−.16	7.56	8002	—	.93	11.14
7708	—	.09	7.65	8003	—	1.34	12.48
7709	—	−.06	7.59	8004	—	.03	12.51
7710	—	.08	7.67	8005	—	−1.51	11.00
7711	—	.22	7.89	8006	—	−.47	10.53
7712	—	−.02	7.87	8007	—	−.32	10.21
7801	—	.12	7.99	8008	—	.80	11.01
7802	—	.15	8.14	8009	—	.51	11.52
7803	—	.10	8.24	8010	—	.44	11.96
7804	—	.08	8.32	8011	—	.50	12.46
7805	—	.07	8.39	8012	—	.11	12.57
7806	—	.17	8.56				

Appendix C

Unanticipated Inflation and Growth in Industrial Production: The Semiannual Database

Livingston collects data in May and November each year on the expected levels of the consumer price index and industrial production in the following December (for the May forecast) or the next June (for the December forecast). The annualized anticipated inflation rate is then computed from the difference between the forecasted price index and the level when the forecast is made. These data have been kindly supplied by Donald Mullineaux of the Philadelphia Federal Reserve Bank and have been calculated following the procedure reported in Carlson (1977).

Unanticipated industrial production growth between May and December, say, is computed as the difference between the actual December level and that forecast for December in the previous May, all divided by the May value. This series is multiplied by 100 to convert it to percentage points. The actual or observed data were collected from issues of the *Business Conditions Digest* and the *Federal Reserve Bulletin*. The first published number was utilized and care was taken to maintain consistency in base years in each calculation.

Unanticipated inflation is the difference between the actual inflation rate between, say, May and December, and that forecasted in May. On the assumption that the April consumer price index was known at the time of the December forecast, the actual inflation rate was computed as the compounded inflation between May and December and then annualized and converted to percentage points. More precisely,

$$\text{ACTINF} = 100\left\{\left[\prod_{i=0}^{7}(1 + I_{t-i})\right]^{1.5} - 1\right\},$$

where I is the monthly inflation rate. The unanticipated inflation variable employed in the monthly inflation and equity returns equations is obtained as $(1 + \text{UNINFA}/100)^{1/12} - 1$.

The fiscal surprise variable is taken from von Furstenberg (1981, table 9, p. 373) for the 1955–78 period. It is the difference between the actual and normal government surplus divided by net national product and converted to percentage points by multiplication by 100. The difference is the residual from a regression equation in which the percentage GNP gap, the lagged change in the unemployment rate, and the difference between actual and officially forecasted inflation rates are employed as regressors. The second- and fourth- quarter values of the surprise variable are used for the June and December data. For 1979 and 1980, this variable has been arbitrarily set equal to zero.

For the December 1954–December 1976 period, the unanticipated change in the new-issue Treasury coupon rate is taken from McCulloch's data (see our table 3.A.3). In order to center the data at mid-June and mid-December, the change during the second half of the year is defined as one-half of the June 1–July 1 change plus the total change from July 1 to December 1 plus one-half the change from December 1 to January 1. For the half-year periods since 1976, we have extended McCulloch's data in the manner described in Appendix B.

The annualized 6-month inflation forecast (the 551 number refers to the forecast for the second half of 1955 made in May), annualized unanticipated inflation, unanticipated growth in industrial production (not annualized), the fiscal surprise (percentage points of net national product), the unanticipated change in the coupon rate, this change divided by the beginning of period level of the new issue coupon, and the latter are all listed in table 3.A.4. All data are in percentage points.

Table 3.A.4 Semiannual Data Base

Date	Expected Inflation	Fiscal Surprise	Unanticipated Inflation	Unanticipated Individual Production	Unanticipated $\Delta R20$	Unanticipated $\%\Delta R20$
512	1.8527	—	.7538	−.06216	−.02	−.00742
521	.3169	—	.0715	−.11514	−.12	−.04404
522	−.1434	—	2.1679	.06453	.09	.03383
531	−.9911	—	−.0441	.05574	.29	.10357
532	−1.3142	—	2.8815	−.03237	−.20	−.06339
541	−.5231	—	1.1283	.00000	−.35	−.11905
542	.1246	—	.1508	.04597	−.04	−.01527
551	.5244	.299	−.6839	.06769	.10	.03724
552	.7433	.440	.4133	.04245	.04	.01399
561	.3436	.957	.0029	−.01528	.01	.00340
562	1.4435	1.269	3.5997	.03830	.41	.13875
571	1.0899	.694	1.8671	−.01973	.06	.01724
572	.0746	.413	2.3509	−.06250	−.16	−.04591
581	.0673	−1.095	2.9441	−.05074	−.42	−.12069
582	.6455	−.965	.6279	.09160	.50	.15576
591	.6118	.073	−.2994	.06972	.23	.06101
592	.9672	.602	1.6456	.07419	.13	.03133
601	.4602	2.223	.4044	.03636	−.36	−.08238
602	.2053	1.688	1.7639	−.07248	−.24	−.05818
611	1.0178	.955	.6405	.04175	−.13	−.03308
612	1.0518	.805	−.0083	.02273	.16	.04113
621	.9932	−.198	−.0489	−.01478	−.11	−.02733
622	.9953	.099	.3388	−.00339	−.05	−.01250
631	1.0212	1.500	−.8308	.03261	.05	.01269
632	.8668	.630	.6263	.01918	.08	.01961
641	1.0960	−.774	.1121	.01572	−.05	−.01192
642	1.2827	.531	.3655	.02883	.01	.00239
651	.9446	.521	.3312	.03577	−.01	−.00235
652	1.5610	−1.473	1.3049	.04003	.24	.05647
661	1.8209	−1.170	1.6202	.05529	.31	.06813
662	2.0501	−2.122	1.6253	.00963	−.04	−.00817
671	2.1049	−2.755	−.0560	−.03907	.22	.04527
672	2.5932	−2.532	1.5570	.01353	.68	.13373
681	3.0848	−2.635	1.4555	.01420	−.14	−.02393
682	2.7118	−1.202	1.7690	.02307	.45	.07792
691	3.1563	.477	2.9057	.04144	.35	.05542
692	3.5959	.714	2.7333	−.00345	.34	.05120
701	3.5504	−.323	2.5353	−.01870	.40	.05698
702	3.5720	−.543	1.7353	−.04152	−1.19	−.15525
711	3.9860	−1.061	.6702	−.01952	.15	.02327
712	3.0325	−.702	−.4596	−.01132	−.74	−.11255
721	3.5777	.038	.0518	.00929	.03	.00491
722	3.2278	−.790	−.0490	.02307	.03	.00483
731	4.0025	−.372	3.1375	.01928	.32	.05024
732	5.1748	−.579	5.1456	−.00646	.19	.02701
741	7.1272	.388	6.0971	−.00711	.85	.11676
742	7.7054	.467	4.8397	−.069323	−.21	−.02599

Table 3.A.4 (continued)

Date	Expected Inflation	Fiscal Surprise	Unanticipated Inflation	Unanticipated Individual Production	Unanticipated $\Delta R20$	Unanticipated $\%\Delta R20$
751	5.6368	−3.284	−.0968	−.085376	.03	.00375
752	5.8424	−.869	1.8686	.038182	−.07	−.00857
761	5.2983	−.489	−.6644	.010127	−.28	−.03390
762	5.2306	−.306	.3962	.030023	−.84	−.10345
771	5.9251	.285	1.8018	.024096	.12	.01624
772	5.9926	−1.039	.1963	−.022367	.16	.02094
781	6.4049	.335	1.6839	−.000716	.62	.07818
782	6.9763	.404	3.3139	.020790	.22	.02554
791	8.3092	.000	4.5474	.009973	1.14	.016
792	10.1440	.000	5.1948	.017173	1.27	.142
801	10.6766	.000	4.6452	−.030223	.32	.031
802	10.5082	.000	−.2392	.070822	1.90	.183

Notes

1. The variability in the real bill rate in the 1952–80 period would likely have been even lower in the absence of deposit rate ceilings. More specifically, the large negative values in 1973 and 1974 are due to bill rates becoming "out of line" relative to private short-term yields due to disintermediation.

2. The premium that equities earned over Treasury bills is similar to the extent that returns on bonds and bills are roughly equal. As is indicated in the last column of table 3.2, government bonds outperformed government bills by nearly 4 percentage points per annum in the 1926–40 period, with the result that the equity premium over bills was significantly greater than that over bonds. The reverse was true, although to a lesser degree, in the 1968–80 perod.

3. Nonetheless, many have attributed the poor performance of equities in the 1969–78 decade to increased inflation and/or uncertainty regarding inflation. Feldstein (1980) has argued that biases in the tax law reduce share values in inflationary periods, while Modigliani and Cohn (1979) have attributed the reduction to an inflation-induced error of investors. Malkiel (1979) has contended that increased uncertainty regarding future price and government regulation changes has lowered share values by increasing the relative risk premium demanded on equity investments. In contrast, one of us has argued that these phenomena explain the relatively modest rise in promised new-issue debt yields (decline in real after-tax yields) but not the sharp decline in share values (Hendershott 1981).

4. Shiller (1979) has suggested that changes in long-term bond coupon rates have been largely unanticipated.

5. Huston McCulloch has constructed the unanticipated changes in long-term Treasury coupon rates in the 1947–77 period. These data are discussed in Appendix B and are employed in the econometric work in secs. 3.2 and 3.4.

6. This comparison is reported in Hendershott (1982).

7. The annualized geometric return over N periods on an asset earning R in period i is $[\Pi_{i=1}^{n}(1 + R_i) - 1]^{N/12}$.

8. Both of these series are described in Appendix B.

9. We value $(1 - \tau_d)R20 - g$ at zero and ρ at 0.06.

10. Because there was also weak evidence that equities earned negative returns relative to bonds around business cycle peaks, a negative turnaround dummy variable was defined analogously to the positive one and tested. The coefficient on this variable was never near a standard error from zero in any bond or equity equation.

11. The Livingston survey data have been questioned by Pearce (1979) on the grounds that they are not "rational" and are less consistent with observed bill rates than are rational inflation expectations. On the other hand, Mishkin (1981) is unsure that the Livingston data are irrational, and Carlson (1981) makes a strong argument that "irrationality" might not be surprising.

12. The precise series used equals $(1. + \mathrm{UNINFA}/100)^{1/12} - 1$, where UNINFA is from the semiannual database listed in Appendix C.

13. When Carlson and Kling (1982) specify expected inflation from an ARIMA model and test for lead or lags between unexpected inflation and real activity via bivariate autoregressions, they, too, find price surprises leading real activity negatively.

14. The Durbin-Watson statistics for the equations in table 3.5 vary between 2.25 and 2.45.

15. See Bodie (1976), Jaffee and Mandelker (1976), Nelson (1976), and Fama and Schwert (1977).

16. The Durbin-Watson statistics for the equity equations over the different time periods vary between 1.95 and 2.15.

17. The equation might be interpreted as suggesting a higher tax rate on dividends; with $\Delta R20/(.55\,R20 + .04)$ as the regressor, the coefficients would sum to $-.45$. With $\Delta R20/(R20 + .04)$ as the regressor, the coefficients sum to -0.75.

18. There is an alternative interpretation. Because unanticipated inflation is greatest precisely when oil shocks occurred, this variable may be capturing nothing more than the negative impact on share values of the unexpected increase in energy prices. We will attempt to distinguish between these two interpretations in future work.

19. The "true" constant term which abstracts from political cycle effects is obtained as the sum of the coefficients on the political dummies and four times the estimated constant, all divided by 4. For eqs. (T3) and (T4), the true constants are 0.0063 and 0.0059.

20. The data are from their table 2, p. 17.

21. The spread between private rates and bills could also be affected by changes in risk and in the level of interest rates. The latter could matter because the income from private securities is taxed at the state and local level while that from bills is not.

22. The CD rates are first of month data recorded by Salomon Brothers.

23. A Cochraine-Orcutt semidifference transformation—with a semidifference parameter of 0.15–0.25—lowers the equation standard error for all of the equations in table 3.9 but hardly changes the coefficient estimates.

24. Thus the result is also consistent with Mishkin's findings (1981) for quarterly data from the 1953–79 period. When the lagged inflation rate is added to eq. (6), the procedure followed by Mishkin, the coefficient is 0.3 and the coefficient on the bill rate declines by a similar amount.

25. For the derivation of a nonzero β from a structural model, see Melvin (1982).

26. The Federal Reserve's capacity utilization rate for manufacturing averaged 84.3% during 1953–69 versus 81.4% for 1970–80. With a desired ratio of 90%, this is a 50% increase in the shortfall.

27. The result differs from Mishkin (1981) who does not find a significant implied relationship between real bill rates and either real GNP growth, the GNP gap, or the unemployment rate.

28. When the lagged inflation rate is added to equation (T4), a coefficient of 0.18 is estimated with a standard error of 0.05, and all other coefficients decline by roughly 18%. That is, the result is consistent with a very short lagged response (18% after the first month) to all variables.

29. On the relationship among new-issue coupon rates on alternative long-term debt instruments, see Cook and Hendershott (1978), Hendershott et al. (1982), and Van Horne (1978).

30. Melvin (1983) provides evidence that the liquidity and inflation effects exactly offset 6 months after an increase in monetary growth.

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Comment Jess Barry Yawitz

Patric Hendershott and Roger Huang have indeed undertaken a major research effort in their paper, "Debt and Equity Yields: 1926–1980." One cannot help but be impressed with this investigation of the return performance of the two major sectors of the financial asset market over nearly a half century. The paper has much to recommend it as a useful first step and, not surprisingly, there is also considerable room for refinements and improvements.

I am pleased to see that nearly all of my original criticisms have been incorporated into the current version of Hendershott and Huang's paper. As a result, my comments will be quite brief. Before proceeding, however, it may be useful to make explicit my major criticism of the Hendershott and Huang paper. I have a strong bias which argues for first developing a set of hypotheses to explain asset returns and then recasting these hypotheses into a testable model. While Hendershott and Huang do attempt to motivate the importance of most of the variables used in their empirical work, a single unifying model is not presented. As a result, the Hendershott and Huang approach generally suffers from being

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too simplistic; they utilize numerous combinations of variables to explain returns, yields, and yield changes without carefully specifying causal relationships.

I suggest that a useful approach to modeling yield spreads and bond returns is first to develop a pricing model. A bond can be viewed as a set of individual financial assets, some of which benefit the borrower and some of which benefit the lender. If a particular feature benefits the borrower, such as a call option, the price of the bond is reduced. Similarly, if the feature benefits the lender, as with a put or attached warrant, the price is higher. When a specific price is observed on a bond, it is apparent that the net value of all of the bond's characteristics is equal to this price.

In the case of new issues, the coupon plays the role of the balancing feature on the bond. Once all of the other characteristics are determined, the coupon generally is set at the particular value that will allow the bond to be sold at par. Since at issue the coupon rate is identical to the yield to maturity, one cannot hope to explain yields without taking explicit account of the other characteristics of the bond.

Hendershott and Huang begin by presenting summary statistics which document the variability in real and nominal rates of return on stocks and bonds over the last half century. The purpose of their paper "is to increase our understanding of the determinants of these variations." While Hendershott and Huang divide their paper into four broad parts, I prefer to view the paper as (1) an exploratory analysis of bond and equity data for the 1926–80 period and (2) an empirical analysis of those factors which were important in determining rates of return on financial assets after 1952.

Hendershott and Huang provide a useful structure in which to explore the yield data compiled by Ibbotson and Sinquefield (1980). As Hendershott and Huang point out, "It makes good analytical sense to examine the data for any regularities without the imposition of too much structure . . ." By "breaking the data" at various points, Hendershott and Huang are able to (1) document the increased volatility in real and nominal bill rates from 1952–80 compared to 1926–51; (2) demonstrate that the premium earned on equities over bonds has varied widely; and (3) show that equities have offered extraordinary positive returns around business cycle troughs and negative returns around peaks. I would strongly recommend that this section of the Hendershott and Huang paper be read by all those interested in studying the return performance of alternative financial assets.

The only econometric analysis performed in the first part of the paper is a series of Granger causality tests applied to bill, bond, and equity returns. Without going into detail, I would suggest that this question needs to be considered in greater detail in light of the efficient market implications of Hendershott and Huang's findings that in several instances lagged returns are important in explaining current returns.

At several points in their paper, Hendershott and Huang attempt to provide empirical support for their hypothesis that changes in long-term (20-year) bond yields have been unanticipated for the most part. This question is addressed by regressing monthly changes in the 20-year Treasury yield on unanticipated changes in this yield. Hendershott and Huang interpret an R^2 of .88 as indicative of the fact that nearly 90% of the changes in long-term bond yields were unanticipated over the period in question. I would point out that the positive and significant constant should be picking up the general upward drift in rates during the period. Since the yield curve was also generally upward sloping, the constant is capturing in part the *anticipated* increase in rates as evidenced in the patterns of forward rates. I also submit that the conclusion that monthly changes in 20-year yields are largely unanticipated is to be expected. A 20-year yield is simply an appropriate average of 240 one-month rates, the current one-month spot rate and 239 one-month forward rates. The expected 20-year yield one month hence contains all 239 forward rates plus one new forward rate. If the period were even shorter than a month, say a day, the expected change in the 20-year yield must be nearly zero.

My earlier point regarding the need for more formal modeling before undertaking the empirical is evidenced in Hendershott and Huang's analysis of the determinants of monthly realized returns on long-term corporate bonds. Hendershott and Huang estimate several equations using the bill rate, a capital gain variable, a business cycle dummy, and unanticipated inflation. While it is possible to hypothesize how each of the independent variables could affect corporate bond returns, Hendershott and Huang need to be more clear on the way that each might do so. This is an instance in which a formal model of yield spreads would be valuable.

In conclusion, let me restate my earlier opinion that this paper is an important first step in what must be an ongoing line of research. It remains for Hendershott and Huang and those of us conducting research in this area to consider in greater detail the menu of questions raised in this paper.