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Returns, Risks, and Pricing of Income Bonds, 1956–76 (Does Money Have an Odor?)*

Within the recent corporate-tax-with-bankruptcy-cost models of optimal capital structure, income bonds, which provide the tax advantages of debt without the bankruptcy-cost disadvantages, are a superior financing instrument. However, U.S. corporations have never issued these bonds in great numbers. In this paper we explore two explanations for the infrequent use of income bonds by U.S. corporations. The traditional explanation is that income bonds have the "smell of death" about them which we interpret to mean that they are persistently "underpriced." The second is that there are some "deadweight" costs associated with income bonds. We conclude that neither of these explanations provides a satisfactory rationale for the reluctance of U.S. corporations to make widespread use of income bonds.

> Income bonds should be used by corporations more extensively than they are. Their avoidance apparently arises from a mere accident of economic history—namely, that they were first employed in quantity in connection with railroad reorganizations, and hence they have been associated from the start with financial weakness and poor investment status. But the form itself has several practical advantages. . . . Chief of these is the deductibility of the interest paid from the company's taxable income. [BENJAMIN GRAHAM]

> Surely we can assume that if the direct and indirect deadweight costs of the ordinary loan contract began to eat up significant portions of the tax savings, other forms of debt contracts with lower deadweight costs would be used instead.
>
> An obvious case in point is the income bond. . . . Income bonds, in sum, are secu-

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rities that appear to have all the supposed tax advantages of debt, without the bankruptcy cost disadvantages. Yet, except for a brief flurry in the early 1960's, such bonds are rarely issued.

The conventional wisdom attributes this dearth to the unsavory connotations that surround such bonds. . . . As an investment banker once put it to me: "They have the smell of death about them." Perhaps so. But the obvious retort is that bit of ancient Roman wisdom: *pecunia non olet* (money has no odor). [MERTON MILLER]

I. Introduction

As the above quotes indicate, substantial controversy has surrounded the use of income bonds by U.S. corporations. On numerous occasions writers in the financial press have encouraged firms to make use of the unique "tax-advantage-without-bankruptcy-cost" opportunity provided by this financing instrument.[1] Despite such encouragements, U.S. corporations have never issued income bonds in great numbers. For example, over the period 1965–76 only eight firms came forth with new issues of income bonds. This total was far exceeded by the number of new issues of fixed-interest bonds, both secured and unsecured, and by the number of new issues of both common and preferred stocks.

The reason that there is no potential for bankruptcy costs with income bonds is that the payment of interest on these bonds is contingent upon the amount of the issuing corporation's reported accounting earnings. If sufficient accounting earnings are available after deduction of operating expenses, allowable fixed-asset depreciation, and interest payments on debt securities with a prior claim on income, the interest due on the income bonds must be paid. However, if reported earnings after deduction of the various allowed expenses are not sufficient to cover contingent interest claims, the income-contingent interest payments can be omitted with no change in the ownership structure of the firm.[2]

In contrast, if a promised coupon payment on a fixed-interest bond is omitted, the bondholders can force the firm into bankruptcy. In theory, bondholders can then take control of certain assets of the firm. In practice, the omission of a promised interest payment usually leads to negotiations between the corporation and its creditors in an attempt to settle the debt obligation outside of court. If the parties are unable to agree, then a bankruptcy petition is filed by either the corporation, an indenture trustee, or the firm's creditors. The court must then decide upon liquidation or reorganization of the firm.[3]

1. See, for example, Robbins (1955, 1974), Bierman and Brown (1967), Barnes (1974, 1975), and Halford (1964).

2. The issuer does have the option of making omitted interest payments cumulative and of determining the maximum number of payments which will accumulate.

3. Warner (1977) provides a more complete discussion of the institutional aspects of corporate default and bankruptcy. Dewing (1953) contains a historical perspective on the institutional aspects of corporate bankruptcy and reorganization through the courts.

In either event, the firm's creditors almost always have greater control over the operations of the firm (i.e., over its investment and financing decisions) after an interest payment is omitted than before. This is true whether the agreement on the settlement of claims is reached outside of court or through bankruptcy proceedings. However, when an income-contingent interest payment is omitted because of insufficient accounting earnings, the bondholders have no more rights (other than the possible future right to accumulated interest) than before the omission of the promised payment.[4] Most important, the bondholders do not have the right to force the firm into bankruptcy when an interest payment is omitted because of insufficient accounting earnings.

Because of the no-bankruptcy feature and because the contingent interest payments are deductible from income for tax purposes, income bonds occupy a unique position in the theory and practice of corporate capital structure management. In the Modigliani-Miller (1963) corporate tax model, debt is a dominant security because of the tax deductibility of coupon interest payments. One of the empirical predictions of this model is that firms will be mostly financed with debt securities. Robichek and Myers (1966) and Baxter (1967) suggested that the existence of bankruptcy costs might account for the failure of firms to employ extremely high debt-to-total-asset ratios in practice. Several recent papers (Kraus and Litzenberger 1973; Scott 1976; and Kim 1978) have built upon Baxter's and Robichek and Myers's suggestion to develop models in which value-maximizing firms balance the tax advantage of debt against the cost of bankruptcy to achieve optimal capital structures. This optimality comes about for the individual firm because the increased use of leverage increases the probability of bankruptcy. As the probability of bankruptcy increases, the present value of future potential bankruptcy costs also increases. At some point, the marginal present value of these costs matches the marginal present value of the tax shield associated with additional debt financing. At that point, the value of the firm is maximized.

In the bankruptcy-cost models, debt is dominated by equity in any individual firm's capital structure only because of the probability that bankruptcy, with its attendant costs, will occur when the firm is highly levered. Within these models, any security that provides the tax advantage of debt, while at the same time eliminating the possibility of

4. A corporation can issue bonds on which some specified fraction of the coupon interest is fixed and the remainder is contingent. Furthermore, the indenture can specify that these fractions change over time. If the firm omits the fixed portion of the interest payment, creditors can file a bankruptcy petition, but not if the contingent interest payment only is omitted. Dewing (1953, chaps. 7, 8) contains a detailed discussion of the contractual rights of the holders of income-contingent bonds and other types of long-term debt securities. He also provides a history of the origins and evolution of the income bond as a distinct financing instrument.

bankruptcy, should dominate fixed-interest bonds as well as equity. As the discussion above indicates, income bonds satisfy this requirement.[5]

Traditionally, the failure of corporations to make use of income bonds in any significant numbers has been attributed to the fact that they were first issued in conjunction with the reorganization of bankrupt railroads. For example, Cohen and Robbins (1976, p. 600) state that "were it not for the continuing stigma attached to the income bond as a result of its emergence from railroad reorganizations, it would undoubtedly be used more widely." One possible interpretation of the traditional rationale for the reluctance of firms to issue income bonds is that a security that "smells of death" trades at a disadvantage in the capital market. That is, the security is persistently undervalued relative to other securities. As a consequence, the returns earned by the owners of these securities over a long period of time would be "too high" relative to the securities' risks. Firms would then be reluctant to issue these securities because they would be required to pay too high a price to raise capital with this particular type of financing instrument.[6]

Alternatively stated, if investors persistently misjudge the future distributions of returns provided by income bonds, these securities would be improperly priced over time. If the expected values of the distributions were systematically underestimated, these securities would earn abnormally high rates of return. Firms would then be reluctant to issue income bonds because their "cost of capital" with this financing instrument would be too high. We label this interpretation of the traditional explanation for the failure of firms to issue larger quantities of income bonds the "persistently mispriced securities hypothesis."[7]

5. As Miller (1977) points out, income bonds do have a fixed maturity date at which time bondholders can force the firm into bankruptcy if principal payments on the bonds are not forthcoming. However, the maturity date can be made arbitrarily distant so as to reduce the present value of the potential bankruptcy costs to (near) zero at the time of the security issue. For example, the Elmyra & Williamsport Railroad issued an income bond in 1863 with a 1,000-year maturity.

6. Quite obviously we are not proposing a comprehensive and internally consistent theory of "inefficient" capital markets. We are merely attempting to cast up the traditional rationale for the reluctance of firms to issue income bonds in an empirically testable form. However, the recent emergence of various anomalous evidence on the use of financing methods (Smith 1978), the pricing of common stocks (Basu 1977; Charest 1978; Thompson 1978; and Watts 1978), and the pricing of options on common stocks (Chiras and Manaster 1978) makes the notion of systematic mispricing of a specific form of security at least plausible. Indeed, the possibility of systematic mispricing was the underlying motivation for Warner's (1977) study of the securities of bankrupt railroads.

7. An alternative explanation of the reluctance of firms to issue income bonds is that the rate premium required by the market for accepting the bonds is deemed too high by firms. In other words, the bonds are priced correctly by the market, but the benefits derived by the issuing firm from having interest payments contingent on earnings are not sufficient to cover the additional costs. This might be the case if there are deadweight costs associated with the use of income bonds that are comparable in magnitude to the deadweight costs of bankruptcy associated with fixed income bonds. This alternative explanation is considered in detail in Section VI of this paper.

The primary purpose of this paper is to test the persistently mispriced securities hypothesis. In doing so, we accomplish two other important objectives. First, we provide a comprehensive documentation of the use of income bonds over the period 1956–76 by U.S. corporations. Second, we present a careful examination of the returns and risks of this unique financial security. Using these return and risk data, we then test the persistently mispriced securities hypothesis by fitting the data to several alternative (but not incompatible) models of the security returns generating process. These experiments are of considerable interest in their own right, because they provide evidence on the ability of the proposed models to explain the returns of securities other than common stocks. Although we find some anomalous results in certain subperiods, when we consider the 21-year period as a whole, we cannot reject the joint hypothesis that market participants properly anticipated the returns to income bonds and that the bonds were priced according to the proposed models.

An alternative explanation for the failure of firms to issue income bonds in greater numbers is that there are certain (as yet not widely recognized) "deadweight" costs associated with this form of financing instrument that are not incorporated in the bankruptcy-cost models of optimal capital structure. In the process of conducting this study, we identified one such source of potential costs—namely, costs arising from conflicts between stockholders and income bondholders over the appropriate computation of "true" accounting earnings. However, a closer examination suggests that these costs are small relative to the tax advantage of debt financing within the Modigliani-Miller (1963) tax model. Furthermore, there exist easily implemented mechanisms to minimize the potential for such conflicts to arise. In the final analysis, we are left with the less than completely satisfying conclusion that we still have no explanation for the infrequent use of income bonds by U.S. corporations.

The outline of the paper is as follows: In the next section we describe the bond sample and selection procedure. In Sections III and IV we examine the properties of the time series of returns and risks of the sample of income bonds over the period 1956–76. Section V contains the results of fitting the time series of returns to several alternative models of the return-generating process. In Section VI we consider the potential for deadweight costs associated with income bonds. A final section contains a summary and concluding remarks.

II. Bond Sample and Selection Procedure

The sample is comprised of all nonconvertible income bonds for which sufficient price quotations were available over the period December 1955–December 1976. Initially a list of outstanding nonconvertible income bonds was compiled for each year from the "blue pages" of the various Moody's *Manuals* (i.e., the *Bank and Financial, Industrial,* and *Transportation* manuals). If at least 24 consecutive month-end price quotations were available in either the *Bank and Quotation Record*, the *Commercial and Financial Chronicle*, or Standard and Poor's *Security Owner's Bond Guide,* the bond was included in the sample. Additionally, for each year the first issue of the *Commercial and Financial Chronicle* and Standard and Poor's *Security Owner's Bond Guide* was searched for any income bonds not included in the Moody's lists. Any additional bonds were then added to the sample if at least 24 consecutive month-end quotes were available.

The resulting sample contains the 53 bonds listed in Appendix A. The Appendix gives the name of the issuing company, the original issue and maturity dates of each bond, the dates on which each bond entered and left the sample, and the reason given by the company for issuing the bond.

Forty-two of the bonds in the sample were issued by railroads with 23 of these being issued as part of corporate reorganization plans. Nine of the remaining bonds were issued by industrial companies, one by an airline, and one by a finance company. The terms to maturity of the bonds vary widely, but they tend to be relatively long with 37 bonds having maturities of 50 or more years. The longest term to maturity is 1,000 years for the Elmyra and Williamsport Railroad bond. There is some clustering of issue dates in the late 1950s with 23 of the bonds issued between mid-1954 and year-end 1959.[8]

Month-end "flat" prices were collected for each bond for any month in which a price quotation was available during the sample period. If an actual transaction price was not available, a bid price was substituted. In this way we were able to construct continuous price series for each bond, the beginning and ending dates of which are indicated in Appendix A.

A complete history of interest payments for each bond was obtained from the relevant Moody's manual. There is considerable variation in the interest payment histories of the individual bonds over the study period: no interest payments were made on one of the bonds; interest payments were always made on 30 of them, and at least one interest

8. We have no explanation for this phenomenon. During late 1953 and early 1954, the *Commercial and Financial Chronicle* contained extensive discussion of the alleged tax advantages that would accrue to firms that issued income bonds to retire preferred stock. This discussion continued over several months in tandem with the debating and drafting of the Omnibus Tax Reform Bill of 1954 in the U.S. Congress. In its original version (as passed by the House of Representatives) the bill would have disallowed the deduction of interest payments on income bonds against earnings when corporations were computing their federal income taxes. However, when the bill was finally signed on August 8, 1954, the provision of the tax law permitting deduction of interest on income bonds remained intact. Thus, these securities apparently were not issued in an attempt to "beat" the tax bill.

TABLE 1 Number of Individual Bond Returns in the File at Year End 1956–76

Year	Number of Returns	Year	Number of Returns	Year	Number of Returns
1956	39	1963	51	1970	48
1957	40	1964	51	1971	47
1958	44	1965	51	1972	47
1959	48	1966	51	1973	47
1960	48	1967	52	1974	47
1961	50	1968	52	1975	47
1962	51	1969	50	1976	41

payment was omitted on the remaining 22. In the 22 cases where an interest payment was omitted, no further interest payments were made on 11 of the bonds. When interest payments were resumed after an omitted payment, they were never discontinued in six instances. Interest payments were resumed on the remaining five bonds only to be discontinued again at a later date. After the second omission, interest payments were never resumed in three cases, resumed and continued in one, and resumed and discontinued in one. There were 13 resumptions in all, and eight of these involved the payment of arrearages.

In terms of the technicalities of their periodic cash payments, income bonds are similar to preferred and common stocks in that interest payments are "declared" by the board of directors. As a consequence, unlike fixed-interest bonds, income bonds trade without accrued interest. Thus, a bondholder receives interest only if he owns the bond on the date of record.[9]

For bonds that were outstanding at the time we began this study, ex-interest dates were determined from correspondence with the appropriate bond trustees. For the few bonds no longer outstanding, ex-interest dates were determined from communication with the relevant corporate treasurer's office. These dates were then cross-checked for accuracy with the *Commercial and Financial Chronicle* and/or Standard and Poor's *Security Owner's Dividend Record*.

A file of monthly rates of return was then created using the bond prices and interest payments described above. A monthly return included an interest payment only if the bond actually went ex-interest during the month. This file contained approximately 12,500 monthly returns. Because the number of bonds in the sample varies over time, the number of individual monthly rates of return in the file varies across months. The number of individual bond rates of return for each December of the study period is shown in table 1. The smallest number of

9. With fixed-interest bonds, the interest is prorated over the time period between interest payment dates. Thus, when an investor sells a bond, he receives the sales price plus a prorated fraction of the next interest payment to be made on the bond. For further discussion of this point see Ibbotson and Sinquefield (1976).

returns in any December is 39 in 1956 and the largest is 52 in 1967 and 1968. The average number of monthly returns per bond is 235, and complete return series are available for 30 of the bonds.

III. Properties of Income Bond Returns

The time series of the monthly returns for the period January 1956–December 1976 on an equally weighted portfolio containing all of the income bonds in the sample is depicted in figure 1. Some perspective on the properties of these returns can be gained by comparing them with the returns on common stocks and fixed-interest corporate bonds over the same time period. Table 2 contains sample statistics that make such comparisons possible. Panel *A* of the table provides selected sample statistics for the entire time series of income bond monthly returns (col. 1), as well as for four subperiods of 63 months each (cols. 2–5). Panels *B* and *C* contain comparable statistics for the time series of monthly returns for the CRSP value-weighted portfolio of NYSE common stocks and for the portfolio of high-grade corporate bonds constructed by Ibbotson and Sinquefield (1976).

The statistics in table 2 permit a preliminary consideration of the persistent mispricing hypothesis. Given the nature of the claim represented by an income bond, we would expect that, *ceteris paribus*, a randomly selected portfolio of income bonds would be more risky than a randomly selected portfolio of fixed-interest, high-grade corporate bonds, but less risky than a randomly selected portfolio of common stocks. Comparison of the estimated standard deviations for the three classes of securities is consistent with our a priori expectations, as the

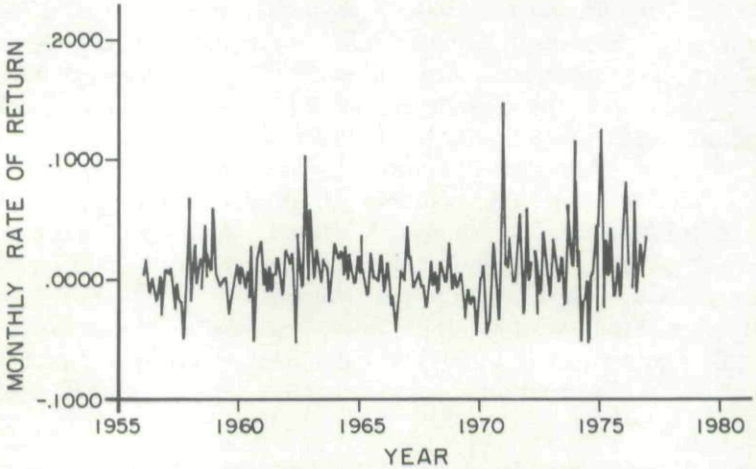

FIG. 1.—Monthly returns on equally weighted portfolio of income bonds, January 1956 through December 1976.

TABLE 2 Sample Statistics, Monthly Returns

	Sample Period				
Statistic	1/56–12/76	1/56–3/61	4/61–6/66	7/66–9/71	10/71–12/76
A. Equally weighted income bond portfolio:					
$\bar{R}_{it}$	.0054	−.0002	.0092	−.0000	.0125
$s(\bar{R}_{It})$	.0280	.0223	.0226	.0290	.0347
Minimum	−.0553	−.0531	−.0546	−.0473	−.0553
Maximum	.1483	.0682	.1047	.1483	.1272
Studentized range	7.3	5.4	7.1	6.7	5.3
Kurtosis	7.7	4.8	7.9	13.1	4.9
Skewness	1.3	.4	1.0	2.2	1.0
ρ_1	.17	.15	.03	.34	.02
ρ_2	.04	.07	−.05	−.06	.04
ρ_3	.06	.05	.17	.04	−.07
B. CRSP value-weighted common stock portfolio:					
$\bar{R}_m$	.0074	.0101	.0074	.0064	.0056
$s(\bar{R}_{mt})$	.0408	.0340	.0335	.0427	.0512
Minimum	−.1170	−.0690	−.0834	−.0996	−.1170
Maximum	.1642	.0691	.1110	.0903	.1642
Studentized range	6.9	4.0	5.8	4.4	5.5
Kurtosis	4.1	2.4	4.6	2.5	4.6
Skewness	.0	−.6	−.3	−.3	.5
ρ_1	.09	.16	.10	.10	.04
ρ_2	−.03	−.00	−.15	−.01	−.01
ρ_3	.07	.01	.10	−.16	.23
C. Portfolio of high-grade fixed-interest corporate bonds constructed by Ibbotson and Sinquefield (1976):					
$\bar{R}_{ft}$	.0032	.0017	.0022	.0023	.0068
$s(\bar{R}_{Ft})$	.0187	.0154	.0061	.0246	.0229
Minimum	−.0476	−.0322	−.0149	−.0471	−.0476
Maximum	.0885	.0685	.0151	.0584	.0885
Studentized range	7.3	6.5	4.9	4.3	5.9
Kurtosis	5.7	7.8	3.8	2.7	5.1
Skewness	.9	1.1	−.3	.5	.7
ρ_1	.13	.41	.19	.04	.10
ρ_2	−.02	−.04	.12	.01	−.12
ρ_3	−.03	−.08	.12	−.17	.11

NOTE.—Fractiles of a sample drawn from a normal population (N = 60):

	.95	.99
Studentized range	5.5	5.93
Skewness	±.492	±.723
Kurtosis	3.57	3.98

variability of income bond returns is greater than the variability of high-grade corporate bonds and less than that of common stocks for the entire study period and for each of the 63-month subperiods.

If we provisionally accept the standard deviation of returns as a measure of risk, the estimated mean returns of the three asset classes can be compared to reach a preliminary judgment on the persistent mispricing hypothesis. Under the standard assumption of risk-averse investors, riskier assets should be priced to yield higher rates of return. Hence, we would expect common stocks to provide higher average returns than income bonds, which, in turn, would be expected to provide higher average returns than high-grade corporate bonds. For the entire time period, our expectations are realized; the average returns were 0.74%, 0.54%, and 0.32% for common stocks, income bonds, and fixed-interest, high-grade corporate bonds, respectively. These results are not consistent with the persistent mispricing hypothesis.

However, there are some anomalous results in various subperiods. In two of the subperiods, income bonds yielded higher average returns than common stocks. In the other two subperiods, they provided lower average returns than did high-grade bonds. Moreover, in the fourth subperiod, high-grade corporate bonds provided higher average returns than did common stocks. These results suggest that income bonds provided returns that were too high in two of the subperiods and too low in the others. These anomalies are troublesome, but they cannot be interpreted as any more supportive of the hypothesis that income bonds are systematically underpriced than of the hypothesis that high-grade corporates are underpriced. A precise statement of the return generating process (which we provide in Section V) is necessary to draw such inferences.

Additional insight into the data is provided by the measures of kurtosis and skewness and by the studentized ranges. For the entire sample period, the distribution of income bond returns appears to deviate from the normal and to be skewed to the right. The studentized range of 7.3 exceeds the 0.99 fractile of a sample of this size drawn from a normally distributed population, as do the coefficients of skewness and kurtosis. Furthermore, the maximum monthly return of 14.83% is nearly three times as large in absolute value as the minimum return of negative 5.53%.

The departures from normality of the distribution of income bond returns are similar to those of the high-grade, fixed-interest bond returns and not terribly dissimilar from those of the distribution of common stock returns. The distribution of returns for fixed-interest bonds has a studentized range of 7.3; it is also leptokurtic and skewed to the right. The distribution of common stock returns also departs from normality as its studentized range is 6.9, which exceeds the 0.99 fractile of a sample of this size drawn from a normal population; the distribution is leptokurtic, but it is symmetric.

The most frequently suggested rationale for the nonnormality of security returns is nonstationarity of the return-generating process. If the distribution of returns is normal at each point in time, but the variance is changing, the sample statistics of a time series may give the appearance of nonnormality. In this case, support for the conjecture is provided by the sample statistics for the subperiod returns.

For all three security classes, the portfolio returns for the individual subperiods do seem to approximate the normal distribution more closely than do the returns for the entire time period. The studentized ranges are uniformly lower for the subperiods than for the whole time period. For common stocks, the distributions do not deviate significantly from the normal. For both classes of bonds, the coefficients of skewness and kurtosis are generally, though not universally, lower for the subperiods than for the entire period. Still, for both sets of bonds, the returns are best characterized as leptokurtic and skewed to the right. Because the measures of risk reported in the following section and the formal tests of the persistent mispricing hypothesis rely upon the assumption of normality, it is important to note departures from that assumption, as they tend to diminish the precision of later estimation results.[10]

Table 2 also gives estimates of the first three autocorrelations of the returns series. For the period as a whole, there is some evidence of serial dependence in the returns of all three asset classes as the first-order autocorrelations are all positive and similar in magnitude. However, only the income bond and fixed-interest bond, first-order autocorrelations are significantly different from zero at the .05 level. Surprisingly, the pattern of first-order autocorrelations across the four subperiods for the income bond portfolio is not similar to that for the fixed-interest bond portfolio. The maximum serial correlation of returns on the income bond portfolio occurs in the third subperiod, while the maximum for the fixed-interest bond portfolio occurs in the first subperiod.

Weinstein (1978) also found a significant first-order autocorrelation coefficient in his study of a random sample of corporate bonds over the period 1965–74. He attributed that result to the fact that some of the bonds in his sample were not actively traded. A similar interpretation may be appropriate for our results as well. In the next section we present direct evidence on that possibility.

10. The properties of the distributions of bond returns reported here are very similar to those reported by Warner (1977) and Weinstein (1978) in their examinations of bond portfolio returns. See MacBeth (1975, pp. 25–28) for a discussion of the robustness of the normality assumption when the true distribution departs from normality.

IV. Risk Characteristics of Income Bonds

One of the fundamental tenets of both modern portfolio theory and the two-parameter asset-pricing model is that the appropriate measure of risk for an individual security is its "systematic" risk defined as the covariance of the asset's return with the return on the market portfolio of all risky assets divided by the variance of return on the market portfolio. If it is assumed that the return-generating process is stationary and multivariate normal, the market model provides an appropriate means of estimating the systematic risk of any asset or portfolio.[11] The market-model equation can be expressed as:

$$\tilde{R}_{jt} = \alpha_j + \beta_j \tilde{R}_{mt} + \tilde{e}_{jt}, \tag{1}$$

where $\tilde{R}_{jt}$ = rate of return on asset or portfolio j in month t; $\tilde{R}_{mt}$ = rate of return on the market portfolio of all risky assets in month t; $\tilde{e}_{jt}$ = a stochastic disturbance term in month t, assumed to have a mean of zero, to be independent of $\tilde{R}_{mt}$ and uncorrelated across j and t; $\alpha_j = E(\tilde{R}_{jt}) - \beta_j E(\tilde{R}_m)$; and β_j = covariance $(\tilde{R}_{jt}, \tilde{R}_{mt})$/variance $(\tilde{R}_{mt})$.

Estimates of the systematic risk of the equally weighted, income-bond portfolio were obtained by regressing its monthly returns against the returns on the CRSP value-weighted portfolio of common stocks using the ordinary least-squares method for estimating equation (1). The resulting estimates are presented in panel *A* of table 3. The beta estimated using all of the data is 0.29, and the subperiod estimates range from 0.25 to 0.41. All of these estimates are significantly different from zero at the .01 level, though in view of the departures from normality reported in the previous section (and which are present in the regression disturbances reported in table 3), caution must be exercised in interpreting the *t*-statistics.

Comparable estimates of systematic risk for the portfolio of high-grade, fixed-interest bonds are presented in panel *B* of the table. For the entire period considered, the beta of the fixed-interest bond portfolio is approximately half that of the income bond portfolio. These estimates are again in line with a priori expectations. The beta estimate for the income bond portfolio is, moreover, greater than that of the fixed-interest bond portfolio in each of the subperiods, though the patterns of risk estimates across the subperiods are quite different. There is an apparent decrease in the riskiness of the income bonds over time and a concurrent increase in the riskiness of the fixed-interest bonds.

However, the indicated decrease in the systematic risk of the income bonds over time may be more apparent than real. These bonds are traded less frequently than most of the common stocks listed on the

11. Fama (1976, pp. 63–132) provides a complete discussion of this model and estimation technique.

TABLE 3 **Estimates of Market Risk for the Bond Portfolios ($\tilde{R}_{it} = \hat{\alpha}_j + \hat{\beta}_j \tilde{R}_{mt} + \hat{e}_{jt}$)**

	Sample Period				
Statistics	1/56–12/76	1/56–3/61	4/61–6/66	7/66–9/71	10/71–12/76
A. Estimates for income bonds:					
$\hat{\alpha}$	.0032	−.0034	.0062	−.0018	.0111
$t(\hat{\alpha})$	1.99	−1.33	2.65	−.51	7.30
$\hat{\beta}$	.29	.32	.41	.27	.25
$t(\hat{\beta})$	7.33	4.40	5.92	3.33	3.10
$s(\hat{e})$	.0254	.0194	.0180	.0267	.0322
Minimum $\hat{e}$	−.0606	−.0548	−.0252	−.0508	−.0406
Maximum $\hat{e}$	.1314	.0604	.0724	.1374	.1183
S.R. ($\hat{e}$'s)	7.6	5.9	5.4	7.0	4.9
$\rho_1(\hat{e})$	.01	.03	−.01	.14	−.19
R^2	.177	.241	.365	.154	.136
B. Estimates for fixed-interest bonds:					
$\hat{\alpha}$	.0022	.0025	.0021	.0006	.0055
$t(\hat{\alpha})$	1.90	1.25	2.65	.21	2.19
$\hat{\beta}$	.15	−.08	.01	.26	.23
$t(\hat{\beta})$	5.30	−1.39	.50	4.01	4.56
$s(\hat{e})$	.0178	.0151	.0060	.0219	.0198
Minimum $\hat{e}$	−.0572	−.0350	−.0171	−.0412	−.0645
Maximum $\hat{e}$	.0720	.0629	.0131	.0455	.0459
S.R. ($\hat{e}$'s)	7.3	6.5	5.0	4.0	5.6
$\rho_1(\hat{e})$	.14	.42	.18	.10	−.01
R^2	.097	.015	.000	.196	.242

NOTE.—S.R. = standardized range on all tables.

NYSE. Scholes and Williams (1977) have shown that the market-model estimates of beta are downward biased for securities that are not frequently traded. They also developed a methodology for obtaining consistent estimates of beta for such securities. When we applied the Scholes-Williams technique to our data, there was a considerable increase in the resulting beta estimates. For the period as a whole, the estimate of beta obtained using the Scholes-Williams technique is 0.48, while the estimates for the four subperiods are 0.41, 0.41, 0.56, and 0.55, respectively. The most dramatic changes are in the last two subperiods wherein the estimates are more than doubled in both instances. These results also support our earlier conjecture that the significant first-order autocorrelations in the returns series resulted from the fact that some of the bonds in the sample were not actively traded.

By way of contrast, the use of the Scholes-Williams technique resulted in beta estimates for the fixed-interest bonds that are similar to those obtained using ordinary-least-squares regressions. The estimate of beta for the entire period is unchanged from that reported in table 3. The estimates for the first three subperiods are virtually the same as those reported in table 3. Only in the fourth subperiod where the Scholes-Williams technique produced an estimate of 0.32 is there any appreciable difference. Thus, the Scholes-Williams estimating procedure results in risk estimates that are more in line with a priori expectations in the later subperiods.

It is interesting to compare our beta estimates with those obtained by others who have investigated the returns on fixed-interest bonds and preferred stocks.[12] In his examination of a random sample of corporate bonds over the period from mid-1962 to mid-1974, Weinstein (1978) reported a mean beta estimate of 0.155 for his total sample with individual bond betas ranging from −0.184 to 0.963. In a study of nonconvertible preferred stocks over the period 1956–66, Bildersee (1973) reported a mean beta of 0.070 for "high quality" preferreds and a mean estimate of 0.423 for "low quality" preferreds. Finally, in his study of defaulted railroad bonds over the period February 1926–November 1955, Warner (1977) reported a beta estimate of 0.75 with subperiod estimates ranging from 0.08 to 1.25.[13]

The estimate of the full period's beta for the fixed-interest bonds is virtually the same as the mean estimate reported by Weinstein, while the income bond portfolio beta of 0.29 is in the upper 10% of his full distribution of bond betas. The income bond estimate is less than that reported by Bildersee for low-quality preferreds, but greater than that for high-quality preferreds. Finally, our estimate of beta for the income bond portfolio is lower than Warner's, but the defaulted bonds in his sample would be expected to more closely resemble common stocks than bonds once default had occurred.

While some caution must be exercised in comparing our results with those of the other researchers because of the differing time periods considered and because of the use of different proxies for the market portfolio, the estimates of beta for the income bond portfolio are reassuringly consistent with a priori expectations. They are generally higher than beta estimates for fixed-interest bonds and high-quality preferred stocks, but lower than those of low-quality preferred stocks and defaulted bonds.

The market model suggests that one index may be sufficient to estimate the risk of a portfolio or security. However, a number of researchers have argued for the use of multiple indexes to identify distinct sources of risk.[14] The returns on the portfolio of fixed-interest bonds may reflect a distinct interest-rate factor which has an effect on income bond returns in addition to the stock "market" factor.

12. In terms of the rights conferred upon the security holders, we might view the income bond as lying somewhere between a fixed-interest bond and a preferred stock.

13. The beta estimates reported in table 4 are comparable to the estimates reported by Bildersee, Weinstein, and Warner. Those obtained with the Scholes-Williams procedure are not.

14. See, for example, Bildersee (1973), Stone (1974), and Ross (1976).

TABLE 4 **Estimates of Risk Factors for the Income Bond Portfolio ($\tilde{R}_{It} = \hat{\alpha}_I + \hat{\beta}_I\tilde{R}_{mt} + \hat{C}_I\tilde{R}_{Ft} + \hat{e}_{It}$)**

Statistics	Sample Period				
	1/56–12/76	1/56–3/61	4/61–6/66	7/66–9/71	10/71–12/76
$\hat{\alpha}$	.0027	−.0039	.0042	−.0019	.0090
$t(\hat{\alpha})$	1.65	−1.51	1.77	−.56	2.15
$\hat{\beta}$	.25	.34	.40	.21	.16
$t(\hat{\beta})$	6.11	4.57	6.03	2.34	1.79
$\hat{C}$	.27	.20	.98	.22	.38
$t(\hat{C})$	2.99	1.25	2.69	1.43	1.87
$S(\hat{e})$	.0250	.0192	.0170	.0263	.0313
Minimum $\hat{e}$	−.0688	−.0610	−.0261	−.0586	−.0645
Maximum $\hat{e}$	.1196	.0613	.0570	.1285	.0459
S.R. ($\hat{e}$'s)	7.5	6.4	4.9	7.1	5.6
$\rho_1(\hat{e})$	.00	.02	−.03	.12	−.14
R^2	.199	.236	.414	.154	.156

The coefficients of determination in panel *B* of table 3 indicate that the returns on the fixed-interest bond portfolio are not so highly correlated with the returns on the common stock portfolio as to make multicollinearity a serious problem in a multiple regression. Therefore, the following "two-index" model was estimated.

$$\tilde{T}_{It} = \alpha_I + \beta_I\tilde{R}_{mt} + C_I\tilde{R}_{Ft} + \tilde{e}_{It} \tag{2}$$

where $\tilde{R}_{It}$ = return on the income bond portfolio in month t; $\tilde{R}_{mt}$ = return on the CRSP value-weighted portfolio of common stocks in month t; $\tilde{R}_{Ft}$ = return on the portfolio of fixed-interest bonds in month t; $\tilde{e}_{It}$ = a stochastic disturbance term in month t, assumed to have a mean of zero, to be independent of $\tilde{R}_{mt}$ and $\tilde{R}_{It}$, and uncorrelated across t; $\alpha_I = E(\tilde{R}_{It}) - \beta_I E(\tilde{R}_{Mt}) - C_I E(\tilde{R}_{It})$; β_I = a measure of the relationship between returns on the income bond portfolio and returns on the portfolio of common stock; and C_I = a measure of the relationship between returns in the income bond portfolio and returns on the portfolio of fixed-interest bonds. The resulting estimates are displayed in table 4.

A comparison of the coefficients of determination contained in table 4 with those included in panel *A* of table 3 reveals that the addition of the second factor results in only a modest increase in the explanatory power of the equation. Nonetheless, the t-values for $\hat{C}$ indicate that the coefficient is significantly different from zero for the period as a whole and in two of the four subperiods. Furthermore, in the fourth subperiod, the t-value for $\hat{C}$ is greater than that of $\hat{\beta}$. These results suggest that an interest rate factor is useful in explaining income bond returns. This possibility is considered explicitly in our formal tests of the persistent mispricing hypothesis in the following section.

V. Risk-adjusted Returns on the Income Bond Portfolio

To formally test the persistent mispricing hypothesis, it is necessary to establish a benchmark to determine if income bonds have provided returns consonant with their level of systematic risk. One frequently used model that has worked well in explaining security returns and is consistent with the Black (1972) version of the capital-asset pricing model is[15]

$$\tilde{R}_{jt} = \tilde{\gamma}_{0t} + \tilde{\gamma}_{1t}\beta_j + \tilde{\eta}_{jt} \qquad j = 1, 2, \ldots, N$$

where $\tilde{R}_{jt}$ = rate of return on asset j in period t; $\tilde{\gamma}_{0t}$, $\tilde{\gamma}_{1t}$ = market determined variables rcpresenting the ex-post relationship between rates of return and risk in time period t. They can vary stochastically from period to period, but $E(\tilde{\gamma}_0) = E(\tilde{R}_0)$ and $E(\tilde{\gamma}_1) = E(\tilde{R}_m) - E(\tilde{R}_0)$, where $E(\tilde{R}_0)$ is the expected rate of return on any asset that is uncorrelated with the market portfolio; $\tilde{\eta}_{jt}$ = stochastic disturbance term in the return on asset j in month t, assumed to be independent of β_j and uncorrelated across t and j; and β_j = relative risk of asset j. This is the model that is used in our initial tests of the persistent mispricing hypothesis. According to the model, the return on asset j in time period t is a function of the overall market parameters $\tilde{\gamma}_{0t}$ and $\tilde{\gamma}_{1t}$ and the security specific variables β_j and $\tilde{\eta}_{jt}$. To use this model to examine abnormal returns on income bonds, we obtained estimates of $\tilde{\gamma}_{0t}$ and $\tilde{\gamma}_{1t}$ for each month of the period beginning January 1956 and ending December 1976 using the procedure developed by Fama and MacBeth (1973). Using these estimates and the ordinary-least-squares estimates of beta presented in panel A of table 3, we computed estimates of month-by-month abnormal returns on income bonds over the period 1956–76 and over the four nonoverlapping subperiods as

$$\hat{\eta}_{It} = R_{It} - \hat{\gamma}_{0t} - \hat{\gamma}_{1t}\hat{\beta}_{It}, \qquad (3)$$

where: $\hat{\eta}_{It}$ = estimated abnormal return for the income bond portfolio in month t; and $\hat{\beta}_{It}$ = estimate of beta for the income bond portfolio; t subscript indicates that separate estimates were used for the period as a whole and the subperiods.

According to at least one interpretation of "street" folklore, income bonds would be expected to exhibit systematically positive abnormal returns. However, if income bonds are priced like other securities, the abnormal returns on income bonds should be distributed randomly around zero over time with a mean abnormal return that is not significantly different from zero (assuming that equation [2] represents

15. See Mandelker (1974) for a discussion of the assumptions underlying this model. Thanks are due to K. Dunn for assistance in estimating the market parameters.

TABLE 5 **Estimates of Abnormal Returns for the Bond Portfolios ($\hat{\eta}_{jt} = R_{jt} - \hat{\gamma}_{0t} - \hat{\gamma}_{1t}\hat{\beta}_j$)**

Statistic	1/56–12/76	1/56–3/61	4/61–6/66	7/66–9/71	10/71–12/76
A. Estimates for income bonds:					
$\bar{\hat{\eta}}_{jt}$	−.0007	−.0146	.0095	−.0087	.0097
$t(\bar{\hat{\eta}}_{jt})$	−.32	−5.44	2.91	−1.66	1.81
$s(\hat{\eta}_{jt})$	.0361	.0214	.0258	.0418	.0428
Minimum $\hat{\eta}_{jt}$	−.1386	−.0725	−.0558	−.1403	−.0718
Maximum $\hat{\eta}_{jt}$	.1683	.0364	.0685	.1226	.1747
S.R. $(\hat{\eta}_{jt})$	8.5	5.1	4.8	6.3	5.8
$\rho_1(\hat{\eta}_{jt})$	.18	.09	.19	.09	.09
B. Estimates for fixed-interest bonds:					
$\bar{\hat{\eta}}_{jt}$	.0039	−.0047	.0150	.0009	.0048
$t(\bar{\hat{\eta}}_{jt})$	1.22	−.91	2.52	.16	.57
$s(\hat{\eta}_{jt})$	.0511	.0411	.0473	.0449	.0668
Minimum $\hat{\eta}_{jt}$	−.1283	−.1308	−.0926	−.0783	−.1197
Maximum $\hat{\eta}_{jt}$	.2268	.1140	.1062	.1102	.2096
S.R. $(\hat{\eta}_{jt})$	6.9	6.0	4.2	4.2	4.9
$\rho_1(\hat{\eta}_{jt})$	.17	.14	.21	.15	.06

an adequate characterization of the process generating security returns).[16]

Estimates of the mean abnormal returns on income bonds, as well as some statistics descriptive of the distribution of the abnormal returns for the period as a whole and the four subperiods are shown in panel *A* of table 5. The cumulation of the monthly abnormal returns is depicted in figure 2. An examination of table 5 reveals that the mean monthly abnormal return over the entire period of the study is −0.07% with a *t*-statistic of −0.32. Thus, over the entire period, the mean abnormal return is not significantly different from zero at any of the usual levels of significance.[17] This result is not consistent with the persistent mispricing hypothesis.

While the mean abnormal return for the entire period is not significantly different from zero, this result does not obtain for the various subperiods considered. Panel *A* of table 5 shows that the four subperiod mean estimates are −0.0146, 0.0095, −0.0087, and 0.0097,

16. Three of the railroads whose bonds were included in our sample filed bankruptcy and/or reorganization petitions during the early 1970s. Because these events may contaminate our results (Warner 1977), the affected bonds were dropped from the sample 12 months before each petition was filed. This procedure could have the effect of biasing upward the results in the last subperiod. However, in a separate set of analyses, we included all of the income bonds and the results were not noticeably different from those reported here.

17. Abnormal returns were also estimated using the Scholes-Williams estimates of beta described in section IV of this paper. The corresponding mean obtained using these estimates is −0.16% per month. It, too, is not significantly different from zero. Estimates for the four subperiods are similar to those shown in table 5.

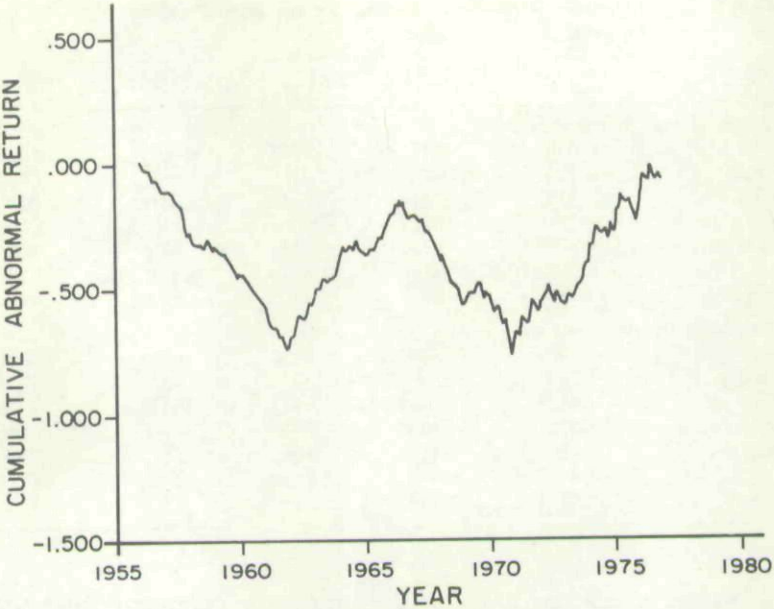

FIG. 2.—Cumulative abnormal returns on equally weighted portfolio of income bonds, January 1956 through December 1976.

respectively, with corresponding t-statistics of -5.44, 2.91, -1.66, and 1.81. Using a one-tail test, three of these are significant at the .05 level and the fourth borders on being significant at that level. Interestingly, the signs of the mean abnormal returns alternate among the intervals with the first and third being negative and the second and fourth being positive. In short, income bond returns appear to be too high in two of the subperiods and too low in the other two. These results are somewhat puzzling and deserve some additional attention.

It is possible that there are factors not captured by the market parameters, $\tilde{\gamma}_{0t}$ and $\tilde{\gamma}_{1t}$, which have an impact on income bond returns. For example, there may be a factor that affects bond returns which could be labeled an "interest rate" factor. To examine that possibility, estimates of abnormal returns for the portfolio of fixed-interest, high-grade corporate bonds were computed using equation (3) and the estimates of beta contained in panel *B* of table 3. These estimates are shown in panel *B* of table 5.

Panel *B* shows that the mean abnormal returns for the fixed-interest bond portfolio are not significantly different from zero for the period as a whole and for three of the four subperiods. Only in the second subperiod is the mean abnormal return significantly different from zero. Nonetheless, the pattern across the four subperiods for the fixed-interest bonds is quite similar to that for income bonds. The mean

TABLE 6 Estimates of Adjusted Abnormal Returns for the Income Bond Portfolio

	Sample Period				
Statistic	1/56–12/76	1/56–3/61	4/61–6/66	7/66–9/71	10/71–12/76
A. Adjusted for interest rate effect ($\hat{\eta}_{It} = \hat{\alpha}_I + \hat{A}_F\hat{\eta}_{Ft} + \hat{e}_{It}$):					
$\hat{\alpha}$	−.0018	−.0138	.0060	−.0091	.0086
$t(\hat{\alpha})$	−.87	−5.35	1.92	−1.86	1.70
$\hat{A}_F$	.28	.17	.23	.36	.24
$t(\hat{A}_F)$	6.73	2.74	3.66	3.28	3.11
$s(\hat{e})$	.0333	.0204	.0236	.0388	.0401
S.R. ($\hat{e}$'s)	7.0	5.4	5.4	5.4	5.6
$\rho_1(\hat{e})$	.05	.01	.18	.02	−.22
R^2	.150	.094	.167	.136	.122
B. Adjusted for interest rate and railroad industry effects ($\hat{\eta}_{It} = \hat{\alpha}_I + \hat{A}_F\hat{\eta}_{Ft} + \hat{A}_R\hat{\eta}_{Rt} + \hat{e}_{It}$):					
$\hat{\alpha}$	−.0015	−.0104	.0051	−.0086	.0086
$t(\hat{\alpha})$	−.76	−4.24	1.78	−1.79	1.70
$\hat{A}_F$	.26	.12	.22	.33	.24
$T(\hat{A}_F)$	6.69	2.00	3.81	2.99	3.16
$\hat{A}_R$	.29	.45	.29	.31	.13
$t(\hat{A}_R)$	4.93	4.08	3.60	2.00	1.02
$s(\hat{e})$	.0318	.0182	.0215	.0379	.0400
S.R. ($\hat{e}$'s)	7.2	5.3	5.4	5.6	5.2
$\rho_1(\hat{e})$	.01	−.06	.19	.02	−.19
R^2	.222	.279	.303	.177	.124

abnormal returns for the two bond classes have the same sign in three of the four subperiods, and, in the other one, the negative mean abnormal return on the income bond portfolio is matched by a very low positive mean on the fixed-interest bond portfolio. These results suggest that the abnormal returns on the fixed-interest portfolio may be useful in explaining the abnormal returns on the income bond portfolio because a common underlying interest rate factor may affect both.

To formally adjust for interest rate effects, the estimates of abnormal return for the income bond portfolio were regressed on the estimates of abnormal return for the fixed-interest bond portfolio using as the estimating equation[18]

$$\hat{\eta}_{It} = \hat{\alpha}_I + \hat{A}_F\hat{\eta}_{Ft} + \hat{e}_{It}, \tag{4}$$

where $\hat{\eta}_{It}$ = abnormal return on income bond portfolio in month t; $\hat{\eta}_{Ft}$ = abnormal return on fixed-interest bond portfolio in month t; $\hat{\alpha}_I$ = adjusted estimate of mean abnormal return for income bond portfolio; $\hat{A}_F$ = adjustment coefficient for interest-rate factor; and $\hat{e}_{It}$ = stochastic disturbance term with a mean of zero, assumed to be independent of $\hat{\eta}_{Ft}$ and uncorrelated across t. The resulting estimates are shown in panel *A* of table 6. Panel *A* shows that there was a significant relation-

18. This two-step procedure was used to make the interest-rate factor independent of the market factor.

ship between the abnormal returns for the income bond portfolio as the coefficient, $\hat{A}_F$, is significant at the .01 level in all periods considered.
coefficient, $\hat{A}_F$, is significant at the .01 level in all periods considered.

Over the period as a whole, the abnormal returns on the fixed-interest bond portfolio explain 15% of the variation in the income bond abnormal returns. Still, the puzzling pattern of abnormal returns shown in table 5 persists. The mean abnormal return is not significantly different from zero for the period as a whole, but it is now significantly different from zero at the .05 level in each of the subperiods if a one-tail test is employed.

One other possible solution to the puzzle is that returns in the income bond portfolio were heavily influenced by events affecting the entire railroad industry. As Warner (1977) has noted, realized returns on different securities in the railroad industry are highly correlated. As a consequence, it may be that the statistically significant measures of abnormal performance in the various subperiods are actually the result of events peculiar to the railroad industry. To examine that possibility, estimates of abnormal returns for a portfolio of railroad common stocks were obtained and used as an additional explanatory variable in the equation explaining abnormal returns on income bonds.

Specifically, an equally weighted portfolio comprised of all the railroad stocks contained in the CRSP monthly files was constructed.[19] Estimates of β were then obtained for this portfolio for the entire sample period and the four subperiods using the market model described by equation (1). Assuming that the return-generating process for the portfolio is described by equation (2), abnormal returns were then estimated for the portfolio of railroad stocks using equation (3).

Estimates of mean abnormal returns for the income bond portfolio, adjusted for both interest rate and industry effects, were then obtained using as the estimating equation

$$\hat{\eta}_{It} = \hat{\alpha}_I + \hat{A}_F \hat{\eta}_{Ft} + \hat{A}_R \hat{\eta}_{Rt} + \hat{e}_{It}, \quad (5)$$

where: $\hat{\eta}_{Rt}$ = estimate of abnormal return for the portfolio of railroad stocks in month t; and $\hat{A}_R$ = adjustment coefficient for the railroad

19. The equally weighted portfolio of railroad common stocks was constructed for the period 1936 through 1976. This more extended period was chosen because we also use this portfolio in analyzing the rates of return on the common and preferred stocks of companies issuing income bonds. These analyses are reported in a companion paper (McConnell and Schlarbaum 1981). The portfolio was reformed every 5 years. All railroad stocks which had a complete return history for the period 1936 through 1940, except those of companies issuing bonds within this period or within 36 months before or after this period, were included in the portfolio for the years 1936 through 1940. (These stocks were excluded because of the nature of the analyses of the rates of return on the common and preferred stocks.) This same selection procedure was then used for each of the subsequent 5-year periods. The resulting return series were spliced together to form a railroad stock portfolio return series for the entire period 1936–76.

industry factor, and all other terms are as defined in equation (4). The resulting estimates are shown in panel *B* of table 6.[20]

The coefficient, $\hat{A}_R$, is significantly different from zero for the period as a whole and in three of the four subperiods. In addition, the coefficient of determination is substantially increased by the addition of the industry factor for the period as a whole and in the first two subperiods. The effect is particularly strong in the first subperiod.

Nonetheless, the estimates of abnormal performance are not much affected by this further adjustment. The mean abnormal return for a period as a whole is -0.15% which is again not significantly different from zero. The estimates for the subperiods are "improved" in the sense that all but one of them are reduced in absolute value and the reduction in the estimate for the first subperiod is quite substantial. However, all of the subperiod estimates are still significantly different from zero at the .05 level if a one-tail test is used. Thus, even the combined effect of interest rate and industry adjustments is not enough to explain the behavior of the abnormal returns in the four subperiods.

The peculiar results for the subperiods notwithstanding, the results over the entire period are consistent with the joint hypothesis that the market properly assessed the distribution of income bond returns over the period 1956 through 1976, and that the bonds were priced according to the two-factor model. The results are also consistent with the joint hypothesis that the market properly assessed the returns distribution to income bonds, and that it priced them according to the proposed three- and four-factor models over this period. Overall, the results do not support the popular contention that income bonds are persistently underpriced. If anything, the results indicate that income bonds earned returns that were too low over the period examined. While there is evidence that the bonds were "improperly" priced over some shorter time intervals, these pricing "errors" were not systematic across the time periods considered.

VI. Potential Deadweight Costs of Income Bonds

In sum, and taken in the aggregate, our results are not consistent with the persistently mispriced securities hypothesis. According to our evidence, income bonds were, on average, "properly" priced over the period 1956–76. However, our results still leave unanswered the puzzling question: Why is it that firms have not issued contingent interest bonds more frequently? One possible solution to this puzzle is

20. We also examined the abnormal returns using the control portfolio approach employed by Warner (1977). While the results for some of the subperiods were altered with this procedure, the general picture that emerged for the entire sample period was not greatly different from those reported in tables 5 and 6.

that there are deadweight costs associated with income bonds that are similar to the bankruptcy costs associated with fixed-interest bonds.

One category of costs which arises in the course of bankruptcy proceedings "involves fees and other compensation to third parties (i.e., the lawyers, trustees, auctioneers, referees, accountants, appraisers, etc.) and represents the administrative expenses of bankruptcy" (Kim 1978, p. 48). The costs are incurred when a promised interest payment is omitted on a fixed-interest bond. As it turns out, there does exist the potential for similar costs to arise when a contingent interest payment is omitted on an income bond. The potential for these costs arises because of a fundamental conflict of interest between income bondholders and common stockholders. The conflict arises because contingent interest payments to bondholders are dependent on reported accounting earnings which typically are under the control of stockholders. Perhaps Dewing (1953, p. 1357) best captures the essence of this conflict:

> As the majority of the old income bond indentures provided that interest should be paid out of net earnings only "if earned," the question arose periodically whether or not the accounting system employed by the management of the reorganized corporation gave a correct interpretation of net earnings. When, as was usually the case, the management controlled the common stock and was different in personnel from the income bondholders, it was distinctly to the advantage of management to represent the earnings to be low, as a consequence of liberal maintenance charges. By such subversive methods of accounting, money which would otherwise be paid to income bondholders and forever lost to the corporation could instead be used to build up the property to such a point that, in the end, the income would justify payments on the common stock quite as well as on the income bonds. *Invariably a controversy would arise*. [Emphasis added][21]

Because it is in the interest of stockholders (ex post) to artificially depress reported accounting earnings and thereby retain and reinvest interest payments that otherwise would have gone to bondholders, when a contingent interest payment is omitted, income bondholders will not know for certain whether it was because earnings were "truly" insufficient or because stockholders employed some form of accounting legerdemain. Thus, when a contingent interest payment is omitted bondholders may have an incentive to initiate court proceedings against the firm. Inevitably such proceedings would involve accoun-

21. Mead (1901) comments similarly on this point: "The security of the income bondholder is the willingness of a board of directors, which he has no share in choosing, to pay over to him sums of money which they have a perfect right to expend on the improvement of the property, a task which is never completed."

tants, lawyers, and other third parties all of whom would require compensation for their services.[22] While we have no way of measuring these costs directly, we did discover two court cases concerned with this specific issue.[23] In both cases, the courts found in favor of the income bondholders and ordered payment of previously omitted contingent interest.

The first case occurred over the period 1907–10 and is reported by Dewing (1953). We have included his discussion of this case in Appendix B. The second case is of more recent vintage. In 1971, 1972, and 1973, the Chicago, Milwaukee, St. Paul, and Pacific Railroad Company omitted contingent interest payments on three of its outstanding bond issues. Subsequently, class-action suits were filed on behalf of each of the three sets of income bondholders.

The Chicago-Milwaukee case concerned two primary issues. The first involved the way in which subsidiary earnings were computed and whether or not such earnings (or losses) should be included when determining the parent company's net earnings available for contingent interest payments. The second concerned the carry-forward of accumulated losses in determining net earnings available for contingent interest payments. On both points, bondholders alleged that the company had used improper accounting procedures which tended to depress reported accounting earnings.

On both points the court found in favor of the bondholders. Quoting from the *Wall Street Journal* (August 11, 1976): "The company . . . will pay about $4.1 million, *less court-approved attorneys' fees and certain costs,* to holders of its Series A and B general mortgage [income] bonds, Terre Haute [contingent interest] bonds assumed by the carrier and 5% income debentures" (emphasis added). The company also agreed to alter its future accounting practices as requested by the class-action suits.[24]

This case and the one reported in Appendix B illustrate the incentive for bondholders to initiate court proceedings when a contingent interest payment is omitted. The *Wall Street Journal* quote illustrates the deadweight costs that such proceedings generate.

We should note again that the omission of a contingent interest payment by means of accounting legerdemain is not in itself a deadweight loss. Such missed payments can easily be priced in the capital

22. These costs might be included under the category of monitoring costs discussed by Jensen and Meckling (1976).

23. There may have been other cases which escpaed our attention.

24. The company subsequently appealed this decision. The case is still before the courts. As of July 1979, no actual payment of the settlement had been made to bondholders. Additional details on this case are available in the annual reports for 1975, 1976, and 1977 of the Chicago, Milwaukee, St. Paul, and Pacific Railroad and in the *Wall Street Journal*.

market (Fama 1978). Rather it is the cost of the court proceedings that is the deadweight loss.[25]

Although we have no way of (immediately) measuring these costs, they appear to us to be small relative to the supposed benefit of tax-deductible interest payments within the Modigliani-Miller (1963) tax model and within the various derivative bankruptcy-cost models of optimal capital structure. More important, there exist ways for the firm to easily circumvent the potential for this type of cost to arise. The most direct way to minimize (or completely eliminate) the incentive for stockholders to conceal earnings is to make the omitted contingent interest payments cumulative and to compound them at an interest rate comparable to the firm's current investment opportunity rate.[26] For this reason, the potential for these costs does not appear to us to be great enough, in itself, to explain the apparent reluctance of U.S. corporations to issue income bonds in greater numbers than they currently do.

VII. Summary and Conclusion

This paper is a comprehensive examination of the returns and risks provided by publicly traded income bonds over the period 1956–76. We use the generated return and risk data to test the hypothesis that income bonds have been persistently underpriced by capital-market participants. This hypothesis has its origin in the financial trade literature and numerous textbooks which attribute the failure of corporations to issue these bonds to the fact that they were first issued in conjunction with the reorganization of bankrupt railroads and have ever since carried with them the "smell of death." If this hypothesis were true, income bonds would exhibit abnormal positive returns over time.

We test the persistently mispriced securities hypothesis by fitting the return data to several alternative specifications of the return-generating process. These include (1) the two-factor (Black) model; (2) the two factor model with an adjustment for interest rate effects; (3) the two factor model with adjustments for both interest rate and industry effects; and (4) the control portfolio method. Furthermore, we fit the models with both ordinary least squares and Scholes-Williams esti-

25. In this regard, it is useful to compare income bonds with preferred stocks. The same incentives exist for common stockholders to omit payment of dividends to preferred stockholders. However, the firm typically has no contractual obligation to pay preferred dividends whether or not sufficient earnings are available. As a consequence, there exists no incentive for preferred stockholders to initiate legal proceedings.

26. Additionally, of course, the usual restrictions on dividend payments and share repurchases would be required. In this regard, it is interesting to note that two of the three bonds involved in the Chicago-Milwaukee case did not provide for the cumulation of omitted interest payments.

mates of "beta." We find that the results obtained are generally very similar with each of these procedures. Specifically, while there are certain anomalous results in various time subperiods, over the entire 21-year period examined, we cannot reject the joint hypothesis that the market properly anticipated the returns to income bonds and that it priced them according to the proposed models.

We then consider the possibility that there is some, as yet not widely recognized, cost associated with income bonds that explains the apparent reluctance of U.S. corporations to make more widespread use of this particular financing instrument. We do discover one such cost which arises because of potential conflicts between stockholders and income bondholders over proper computation of accounting earnings. However, we conclude that the potential for these conflicts to arise is easily eliminated. Thus, in the final analysis we have no complete explanation for the infrequent use of income bonds by U.S. corporations.

Appendix A
List of Income Bonds in Sample

Issuing Company	Coupon Interest Rate	Year Issued	Year Matures	Date Entered Sample	Date Left Sample	Purpose
American Steel & Pump Corp.	4.00	1954	1994	12/55	12/70	Refund short-term debt
Armour & Co.	5.00	1954	1984	12/55	12/76	Exchange for preferred stock
Atchison, Topeka & Santa Fe Railway Co.	4.00	1895	1995	12/55	12/76	Reorganization
Boston & Maine Railroad	4.50	1940	1970	12/55	12/76	Exchange for long-term debt
Budget Finance Corp.	6.00	1960	2010	5/62	12/76	Exchange for preferred stock
Central of Georgia Railway	4.50	1948	2020	12/55	12/76	Reorganization
Chicago & Eastern Illinois Railroad Co.	5.00	1954	2054	12/55	12/76	Exchange for preferred stock
Chicago & Great Western Railway Co.	4.50	1938	2038	12/55	12/76	Reorganization
Chicago, Indianapolis & Louisville Railroad Co.	4.00	1943	1983	12/55	12/76	Reorganization
Chicago, Indianapolis & Louisville Railroad Co.	4.50	1943	2003	12/55	12/76	Reorganization
Chicago, Milwaukee, St. Paul & Pacific Railroad Co.	4.50	1944	2019	12/55	12/76	Reorganization
Chicago, Milwaukee, St. Paul & Pacific Railroad Co.	5.00	1955	2055	12/55	12/76	Exchange for preferred stock
Chicago, Rock Island & Pacific Railroad Co.	4.50	1955	1995	12/55	12/76	Exchange for preferred stock
Chicago, Terre Haute & Southeastern Railway Co.	2.75 + 1.50*	1946	1994	12/55	12/76	Refund long-term debt
Curtis Publishing Co.	6.00	1956	1986	11/56	4/69	Exchange for preferred stock
Delaware, Lackawanna & Western Railroad Co.	5.00	1945	1993	12/55	7/76	To facilitate merger

Denver, Rio Grande & Great Western Railroad Co.	3.00 + 1.00*	1943	1993	12/55	12/76	Reorganization
Denver, Rio Grande & Western Railroad Co.	4.50	1943	2018	12/55	12/76	Reorganization
Denver & Salt Lake Railroad Co.	3.00 + 1.00*	1947	1993	12/55	12/76	Refund long-term debt
Elmyra & Williamsport Railroad Co.	5.00	1863	2862	12/57	2/67	To facilitate merger
Erie Railroad Co.	5.00	1955	2020	12/55	12/76	Exchange for preferred stock
General Baking Co.	6.00	1966	1990	1/67	12/76	Exchange for preferred stock
General Cigar Co.	5.50	1957	2015	7/57	12/76	Exchange for preferred stock
Gulf, Mobile & Ohio Railroad Co.	5.00	1940	2015	12/55	12/76	Reorganization
Gulf, Mobile & Ohio Railroad Co.	4.00	1947	2044	12/55	12/76	Reorganization
Gulf, Mobile & Ohio Railroad Co.	5.00	1957	2056	1/58	12/76	Exchange for preferred stock
Lehigh Valley Railroad Co.	4.00	1949	2003	12/55	7/76	Reorganization
Lehigh Valley Railroad Co.	4.50	1949	2003	12/55	7/76	Reorganization
Lehigh Valley Railroad Co.	5.00	1949	2003	12/55	7/76	Reorganization
Maine Central Railroad Co.	5.50	1959	2008	10/59	2/69	Exchange for preferred stock
Minneapolis, St. Paul & Sault Ste. Marie Railroad Co.	4.50	1944	1971	12/55	11/70	Reorganization
Minneapolis, St. Paul & Sault Ste. Marie Railroad Co.	4.00	1944	1991	12/55	12/76	Reorganization
Missouri-Kansas-Texas Railroad Co.	5.50	1958	2033	1/59	12/76	Exchange for preferred stock
Missouri Pacific Railroad Co.	4.75	1955	2020	3/56	12/76	Reorganization
Missouri Pacific Railroad Co.	4.75	1955	2005	3/56	12/76	Reorganization
Missouri Pacific Railroad Co.	5.00	1955	2045	3/56	12/76	Reorganization
Monon Railroad Co.	6.00	1958	2007	4/58	12/76	Exchange for preferred stock
New York, Chicago & St. Louis Railroad Co.	4.50	1955	1989	12/55	12/76	Exchange for preferred stock

Appendix A
(Continued)

Issuing Company	Coupon Interest Rate	Year Issued	Year Matures	Date Entered Sample	Date Left Sample	Purpose
New York, Susquehana & Western Railroad Co.	4.50	1953	2019	12/55	1/76	Reorganization
Norfolk & Western Railway Co.	5.85	1965	2015	1/67	12/76	Exchange for preferred stock
Peoria & Eastern Railway Co.	4.00	1890	1990	12/55	7/76	Reorganization
Pittsburgh Brewing Co.	5.00	1958	1992	8/58	7/70	Exchange for preferred stock
St. Louis–San Francisco Railway Co.	5.00	1956	2006	9/56	12/76	Exchange for preferred stock
St. Louis–Southwestern Railway Co.	4.00	1891	1989	12/55	12/76	Reorganization
Southern Indiana Railway Co.	2.75 + 1.50*	1946	1994	12/55	12/76	Exchange for long-term debt
Sheraton Corp.	6.50	1956	1981	4/61	12/76	Expansion and construction
Sheraton Corp.	7.50	1959	1989	1/59	12/76	Expansion
Trans World Airlines	6.50	1961	1978	5/61	12/76	. . .
Virginian Railway Co.	6.00	1958	2008	12/58	12/76	Exchange for preferred stock
Wabash Railroad Co.	4.00	1941	1981	12/55	12/76	Reorganization
Wabash Railroad Co.	4.25	1941	1981	12/55	12/76	Reorganization
Western Pacific Railroad Co.	5.00	1954	1984	12/55	12/76	Exchange for preferred stock
Wisconsin Central Railroad Co.	4.50	1954	2029	12/55	12/76	Reorganization

*Fixed plus contingent interest.

Appendix B

Below is a description, excerpted from Dewing (1953, pp. 1360–61), of a court case between the Central of Georgia Railway and the holders of its income bonds over accounting methods used in determining earnings available for payment of contingent interest. This case demonstrates the potential conflict between stockholders and bondholders over accounting procedures. In this particular instance, the court ruled in favor of the income bondholders and ordered immediate payment of previously omitted contingent interest from "recomputed" net earnings.

One of the most interesting controversies of this kind arose in connection with the income bonds of the Central of Georgia Railway, and the case acquired a permanent significance owing to the litigation arising from it. This road had its origin in a reorganization of the old, long-established Central Railroad of Georgia in 1895. As a result of the reorganization, the company was burdened by three issues of income bonds, preceding a relatively small issue of stock. This is shown by the financial plan (small underlying issues not specifically mentioned):

Mortgage bonds (fixed charge securities):		
Prior	$ 18,840,000	
General mortgage	7,000,000	
Consolidated mortgage	16,500,000	
Total fixed charge securities		$ 25,340,000
Income bonds (contingent charges):		
First preference, 5% noncumulative (Interest to be paid if earned)	$ 4,000,000	
Second preference, 5% noncumulative (Interest to be paid if earned, after the first preference)	7,000,000	
Third preference, 5% noncumulative	4,000,000	
Total contingent charge securities		15,000,000
Common stock		5,000,000
Total securities		$ 45,340,000

From this it will be observed that $5,000,000 common stock, possessing, in the years immediately following the reorganization, only a nominal value of a few dollars a share (the third income bonds were quoted at 7% five years after the reorganization) controlled over $40,000,000 of securities. Obviously, it was for the advantage of the common stockholders to build up the physical condition of the road by deflecting earnings to betterments. This could be accomplished by surreptitiously charging such betterments to the ordinary maintenance accounts. As a result little or no margin would appear to remain, after the payment of fixed charges, to apply to the contingent charges on the three income bond issues. And as these charges were not cumulative, the management could gradually build up the road from money that might have been paid to the income bondholders had a different system of accounting been used.

This is exactly what was done. The earnings of a subsidiary steamship company were deflected to capital account, the maintenance charges were increased to an amount well above those of other southern roads and far above the average for the country as a whole. During 1907, by such a system of adroit accounting, the management had been able to pay 5% on the first income bonds, 3.729% on the second, and to show $32.95 as a remainder of the over $12,000,000 gross earnings. Court proceedings were brought against the management to force the admission of secret earnings, and the payment of the full interest on all the income bond issues. The following was the court's findings:

Net earnings, after fixed charges admitted by the railroad	$ 461,030
Additional net earnings, added by the court:	
Earnings of the subsidiary steamship line that should have been paid to the railroad	544,300
Excessive reserve for unadjusted claims on lumber freight	100,000
Excessive maintenance	240,110
Minor adjustments, credit	81,223
Minor adjustments, debit	102,828
Total net earnings available for income bond interest	$1,323,934
First, second, and third income bond interest	750,000
Surplus available to common stock	573,934
Equivalent to	11.4%

This decision was rendered in 1910 and referred to the year 1907.

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