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New Evidence That Taxes Affect the Valuation of Dividends

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ABSTRACT

This paper uses British data to examine the effects of dividend taxes on investors' relative valuation of dividends and capital gains. British data offer great potential to illuminate the dividends and taxes question, since there have been two radical changes and several minor reforms in British dividend tax policy during the last 30 years. Studying the relationship between dividends and stock price movements during different tax regimes offers an ideal controlled experiment for assessing the effects of taxes on investors' valuation of dividends. Using daily data on a small sample of firms, and monthly data on a much broader sample, we find clear evidence that taxes affect the equilibrium relationship between dividend yields and market returns. These findings suggest that taxes are important determinants of security market equilibrium and deepen the puzzle of why firms pay dividends.

FINANCIAL ECONOMISTS HAVE LONG been puzzled by corporate dividend behavior. Many individual investors should value a dollar of corporate dividends less than a dollar of corporate retentions, because the former gives rise to greater tax liabilities. Corporations, however, face equal costs of paying out dividends and retaining earnings. Miller and Modigliani [31] demonstrated that, in the absence of taxes, dividend policy should have no effect on share valuation. If dividends are tax penalized, however, a value maximizing firm should pay no dividends. Widespread dividend payments to taxable investors are therefore surprising. In 1981, dividend tax revenues in the United States were estimated to exceed 20 billion dollars.[1] Indeed, some have interpreted the large volume of dividends paid as evidence against the rational behavior postulates typically used by economists.

The dividend question has stimulated a large theoretical and empirical literature concerned with the question of investors' valuation of dividends. In particular, the question of how taxes affect the market valuation of dividends has generated considerable controversy. Numerous studies including Auerbach [2], Litzenberger and Ramaswamy [24, 26], Morgan [34], and Rosenberg and Marathe

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[1] This was calculated by multiplying the 61 billion dollars of dividends paid by the nonfinancial corporate sector (see the *Economic Report of the President*, 1983, Table B-12) by an estimate of the average marginal tax rate on dividends. Feldstein, Dicks-Mireaux, and Poterba [10] calculated effective dividend tax rates for years prior to 1980. Their marginal tax rate on dividends for 1979 was 0.345. Since few investors are likely to experience changes in their marginal tax rates because of dividend receipts, the average and marginal rates are very similar.

[39], have isolated relationships between stock returns and dividend yields which are consistent with the existence of tax effects. Others, including Gordon and Bradford [13] and Miller and Scholes [33], have presented contrary evidence or suggested alternative explanations. Indeed, Miller and Scholes go so far as to claim that "after correcting... for information effects, we find no significant remaining relation between returns and expected dividend yields—certainly nothing that could be considered a yield-related tax effect of the classic kind [33, p. 1131]."[2]

A full understanding of how dividends affect returns still eludes us, in part because of the difficulties involved in constructing satisfactory empirical measures of ex ante security returns. The finding that ex ante returns and dividend yields are positively correlated may reflect either inadequate risk corrections, other problems in modelling ex ante returns, or tax effects. Without substantial *changes* in dividend tax rates, these hypotheses are difficult to distinguish.

This paper presents the results of our research on dividends and taxes using British data. British data offer great potential to illuminate the dividend valuation question because there have been two radical changes and a number of minor changes in British dividend tax policy during the last 30 years. Tax reforms affecting both ordinary investors and broker-dealers have occurred. Examination of the relationship between dividends and stock price movements during different tax regimes offers an ideal controlled experiment for assessing the effects of taxes on investor's valuation of dividends. This opportunity is not available in the United States, where there have been no comparably radical tax reforms.

Our results confirm the view that the taxation of dividends reduces their relative valuation by investors. Using daily data on a small sample of companies and monthly data on a much broader sample, clear evidence that taxes change equilibrium relationships between dividend yields and market returns is presented. The finding that dividend taxes are recognized by investors and affect the ex ante returns which they demand only deepens the puzzle of why firms pay dividends.

The paper is organized as follows. Section I describes the evolution of the British tax system over the last 30 years and discusses the tax reforms which provide the basis for our empirical tests. We consider both the tax treatment of individual investors and the rules governing arbitrage by broker-dealers around ex-dividend days. Section II utilizes the ex-day methodology to examine tax effects for a small sample of companies. Section III describes our primary data set, the London Business School monthly share price data base, and reports on the relationship between monthly dividend yields and market returns during alternative tax regimes. Our conclusions are presented in Section IV.

I. The Taxation of Dividends in the U.K.

During the last 30 years, Britain has undergone two substantial reforms in the taxation of capital income. If dividend taxes affect the marginal investor, then

[2] Miller and Scholes' arguments regarding information effects in fact apply only to a subset of previous studies, those which did not explicitly control for information and dividend announcements.

the relative valuation of dividends and capital gains should change when the tax law changes. The major changes in British corporate income taxation can safely be viewed as exogenous. Both occurred following changes in the political party in power, after elections in which taxes were not an important issue.

The tax changes we consider concerned the treatment of dividends and capital gains. The first important change occurred in 1965, when the newly elected Labour Government instituted a capital gains tax at a statutory rate of 30 percent. This reform should have increased shareholders' relative valuation of dividend income. The second change occurred in 1973, when the Conservative Government introduced an integrated corporate income tax which effectively reduced the dividend tax rate on personal and corporate investors and actually provided a dividend subsidy to untaxed institutions.

We begin by clarifying how the different tax systems affect investors' relative valuation of dividends and capital gains. Assume that different securities yield different combinations of certain capital gains (g) and dividends (d) per unit value. Let m equal the marginal dividend tax rate, and z the effective tax rate on capital gains. All investors face the same tax rates[3] and require an after-tax return of $(1 - m)r$, where r is the taxable return on a riskless bond. Asset market equilibrium requires that:

$$(1 - z)g + (1 - m)d = (1 - m)r. \tag{1}$$

The tax unadjusted return on a share with dividend yield d and capital gain g is $R = g + d$. Using (1), we can write

$$R = g + d = \frac{(1 - m)}{(1 - z)}r + \left(\frac{m - z}{1 - z}\right)d = \frac{(1 - m)}{(1 - z)}r + \delta d \tag{2}$$

where $\delta = (m - z)/(1 - z)$. When $m > z$, the pretax return on higher yield securities is higher than that on low dividend shares to compensate investors for the extra taxes which they must pay. Prior to 1965, there was no capital gains tax so $\delta = m$. Between 1965 and 1973, when Britain's tax system was very similar to that in the United States, investors faced both dividend and capital gains taxes, and $\delta = (m - z)/(1 - z)$.

In April 1973, the tax system was reformed in a way which substantially reduced the tax rate applicable to dividend income. Investors were permitted to take a partial tax credit for *corporate* tax payments in evaluating their dividend tax liability. This is similar to the tax integration proposals which have been suggested to eliminate the "double taxation" of dividends in the United States. Equivalently, in the post-1973 British system, the corporate tax is a withholding mechanism for collecting the dividend tax. The amount withheld is "imputed" to

[3] Equation (1) would hold if all investors faced the same tax rates. In situations with important heterogeneity in the tax treatment of dividends and capital gains, however, this expression would be replaced by a complicated weighted average of individual tax parameters. Our exposition focuses on the "marginal investor," in part because of difficulty with the existing theories of how equilibrium is achieved in the presence of differential taxes. Shaefer [40] addresses some of these questions.

the shareholder, and δ becomes:

$$\delta = \frac{\dfrac{m - \tau_a}{1 - \tau_a} - z}{1 - z} \tag{3}$$

where m still denotes the dividend tax rate and τ_a is the imputation rate. This formula could, of course, also describe the pre-1973 system, with $\tau_a = 0$.

The workings of an imputation system are most easily demonstrated by way of an example. Suppose a firm pays a £2.00 dividend to a shareowner in the 50 percent tax bracket. Assume that $\tau_a = 0.33$, implying that corporate tax payments worth 33 percent of the dividend can be applied as a credit against individual dividend taxes. Personal taxes are calculated on grossed-up dividends, rather than dividends net of withholding at the corporate level. Therefore, the tax base for the 50 percent dividend tax is £3, and the shareholder's total tax liability is £1.50. Of this liability, £1 is accounted for by the money which was withheld at the corporate level, leaving a personal tax liability of £0.50, 25 percent of the dividend received after withholding. For an investor in the 33 percent tax bracket, no further taxes are due. For shareholders with tax rates *below* τ_a, the Inland Revenue provides a refund of $(m - \tau_a)/(1 - \tau_a)$ times the dividend.[4]

To provide some measure of the changes in the dividend tax burden in 1965 and 1973, Table I presents estimates of the average marginal tax rates on dividends and capital gains implied by the tax rules and the distribution of share ownership for the years 1955–1981. These tax rates were calculated by first estimating the average marginal tax rates applicable to different classes of shareholders, and then averaging these rates across investor classes with weights proportional to the shareholders' total equity holdings. A detailed description of the procedures used in deriving these tax rates can be found in King [21] and King, Naldrett, and Poterba [22].

The third column of Table I presents our summary measure, δ, for the tax system's treatment of dividends and capital gains. Table I shows both the sudden changes in average marginal tax rates caused by the two tax reforms, and the slower movements which result from trends in the pattern of share ownership. The trend towards institutional share ownership has reduced the marginal tax rates on both dividends and capital gains during the last 20 years.[5] We should emphasize that the weighted average tax rates are only designed to provide a rough guide as to the magnitudes of tax changes. No theory holds that asset returns should be governed by weighted average marginal tax rates of the type computed here.

Table I suggests substantial changes in effective tax burdens. Prior to 1965, in what we refer to as Regime I, δ averages 0.50. This reflects a substantial tax burden on dividends and the absence of capital gains taxes. Between 1965 and

[4] Prior to 1973, some investor income tax was withheld "at source" so the actual cheque received by shareholders was less than the announced dividend. After 1973, shareholders received the full announced dividend.

[5] Data on share ownership proportions for the U.K. may be found in King, Naldrett, and Poterba [22].

Table I

Marginal Dividend and Capital Gains Tax Rates

Year	Weighted Average Marginal Dividend Tax Rate (m)	Weighted Average Effective Capital Gains Tax Rate (z)	Excess Return Per Pound of Dividends (δ)
1955	0.518	0.0	0.518
1956	0.516	0.0	0.516
1957	0.515	0.0	0.515
1958	0.498	0.0	0.498
1959	0.484	0.0	0.484
1960	0.486	0.0	0.486
1961	0.485	0.0	0.485
1962	0.483	0.0	0.483
1963	0.483	0.0	0.483
1964	0.518	0.0	0.518
1965*	0.533	0.0/0.184	0.533/0.427
1966	0.489	0.174	0.381
1967	0.488	0.172	0.382
1968	0.481	0.169	0.375
1969	0.469	0.157	0.370
1970	0.452	0.152	0.353
1971	0.441	0.149	0.346
1972	0.420	0.148	0.319
1973*	0.402/0.049	0.143	0.302/−0.109
1974	0.107	0.134	−0.031
1975	0.049	0.130	−0.093
1976	−0.015	0.132	−0.169
1977	−0.045	0.134	−0.207
1978	−0.050	0.135	−0.214
1979	−0.069	0.136	−0.237
1980	−0.129	0.134	−0.304
1981	−0.121	0.133	−0.293
Average Values:			
Regime I (1955–1965)	0.4997	0.0	0.4997
Regime II (1965–1973)	0.4662	0.1621	0.3639
Regime III (1973–)	−0.0277	0.1343	−0.1870

Source: King [21], King, Naldrett, and Poterba [22], and authors' calculations.

* The data for 1965 and 1973 refer to the months before and after the April tax reforms.

1973, δ averages 0.36, lower than in Regime I largely because of the capital gains tax. Finally, since 1973, δ has actually been negative in many years. The average value of δ during Regime III is −0.187. Investors with dividend tax rates (m) below τ_a receive government rebates for taxes paid by the dividend-paying firm. An untaxed institution in receipt of a one-pound dividend can therefore receive an additional 30 pence, making the effective dividend tax rate negative. The substantial shareholdings of these institutions account for the negative weighted average tax rates during Regime III.

There have also been important changes during the last two decades in the tax

rates affecting securities traders involved in tax arbitrage around ex-dividend days. The most significant changes affecting short-term traders were introduced in the 1970 Finance Act.[6] Prior to 1970, "dividend stripping" by trading around ex-days was apparently widespread. Since then, however, the Inland Revenue has been empowered to levy penalties on investors engaging in securities transactions which are principally motivated by tax considerations. For an individual investor, if trading around ex-days such as selling shares before the ex-day and repurchasing them later reduces his tax liability by more than 10 percent in any year, the tax savings from these transactions may be voided by the Inland Revenue.

The Act also placed restrictions on institutions and brokers. After 1970, trading by institutions around ex-days could be declared void if they bought and then sold the same share within one month of its ex-dividend day. If its transactions are disallowed, the institution could be required to pay taxes, in spite of its tax-exempt status. Since 1970, a dealer who trades in a security around its ex-day and holds his shares for less than a month, the marginal trader in Miller and Scholes' [33] parable, will not be able to deduct his full capital loss from taxable income. A fraction of his capital loss, varying inversely with the holding period, is disallowed for tax purposes. As the holding period declines to only the ex-day, the fraction disallowed rises to nearly 100 percent.

The interactions among these tax provisions are difficult to describe, and the extent to which the Board of Inland Revenue exercised its authority remains unclear. However, one cannot doubt that the opportunities for avoiding taxes by trading around ex-days were substantially reduced in 1970. To the extent that trading around ex-days is important in determining ex-dividend price movements, we would expect to observe changes in dividend valuation in 1970.

II. Dividend Valuation: Tests Using Daily Data

The most straightforward test for the existence of dividend tax effects on stock prices is the comparison of share price movements and dividend payments on ex-dividend days. Numerous authors, including Elton and Gruber [7], Black and Scholes [3], Green [14], Kalay [18], Eades, Hess, and Kim [6], Auerbach [2], Hess [17], and others have used daily data to analyze relative share price movements in the United States. These studies have found that, in general, share prices do decline on ex-days, but by less than the amount of the dividend.

These results have been interpreted as supporting the hypothesis that taxes influence market behavior, since shareholders discount future dividend taxes. However, Black and Scholes [3], Green [14], and Kalay [18] suggested that short-term trading by tax arbitrageurs renders the ex-day approach powerless in measuring tax effects. If short-term traders are the marginal investors around the ex-day, then estimated share price movements will not reflect the tax rates facing the firm's "usual" clientele. Moreover, since one of the most likely arbitrageurs is the securities broker who faces identical tax rates on dividend

[6] Kaplanis [20] and Tiley [41] discuss these trading rules in greater detail.

income and on short-term capital gains ($m = z$), this short-term arbitrage should induce share prices to decline by the full value of their dividends.[7]

As we noted above, there were changes in the rules concerning ex-day trading during our sample period, particularly in 1970. If the short-term trading hypothesis is correct, then we would expect to see relative price movements which were closer to -1.0 before 1970 than in later years. These predictions are not borne out by the data. If anything, the opposite has occurred and relative price movements have narrowed in recent years. This is the prediction of the tax-effects hypothesis, not the short-term trading model, and explains in part why we favor it as an explanation of share price reactions to dividends.

To estimate the share price response to dividends, we obtained daily data on the share prices and dividends of 16 large U.K. firms.[8] Using information on ex-dividend dates obtained from the London Business School share price data tape, we consulted microfilm copies of the *Financial Times* and recorded closing share prices on the trading day before the ex-date, the ex-date itself, and the day after the ex-date. For each firm in the sample, we included all ex-dates between 1955 and 1981 corresponding to cash dividend payments which were taxable as ordinary income and not accompanied by any dividend rights, stock options, or other special features. Our data set contained returns for 633 ex-days and 616 non-ex-days. We also obtained data on the value of the *Financial Times*-Actuaries 500 Share Index for each day on which prices were measured, and used this index to construct a market return series.

We estimated two models for R_{it}, the total pretax return on security i. The first is

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \sum_{j=1}^{3} \alpha_j I_{jit} d_{it} + \nu_{it} \tag{4}$$

where R_{mt} is the market return and β_{1i} is a company-specific coefficient which should resemble the security's beta. The dividend yield on each day is d_{it}, and I_{jit} is an indicator variable for the it^{th} dividend falling within tax regime j, $j = 1, 2, 3$. The α_j coefficients reflect the excess pretax return on ex-dividend days, providing estimates of δ for each tax regime. If the tax-effects hypothesis is correct, then the parameter α_j should depend upon the relative tax rates on dividends and capital gains. In particular, we would expect α_j to vary across tax regimes.

The second equation which we estimated restricted the intercept terms, β_{0i}, to be equal across all firms. These equations were estimated by a feasible generalized least squares (GLS) procedure which allowed for heteroscedasticity across firms.

[7] There have been several recent papers concerned with the question of trading around ex-dividend days, including Kalay [18], Elton, Gruber, and Rentzler [8], and Kalay [19]. These papers present conflicting estimates of the transactions costs associated with trading around the ex-day in the United States. While we are aware of no comparable estimates for Britain, we believe transactions costs are at least as great as in the United States. This makes ex-day arbitrage less attractive.

[8] A listing of these firms and the periods covered by our data is available from the authors upon request. We began with a sample of 20 large, nonnationalized industrial firms selected from Fortune's 1981 listing of the world's largest 500 industrial corporations. For four firms, substantial evidence of nontrading, especially early in the sample period, or other difficulties in finding comparable price series through time, led to exclusion from the sample.

Since there were few instances in which two firms had coincident ex-days, residual correlation across firms was not an issue.

The results of our ex-day share price study are shown in Table II. The first two rows show the results of estimating (4) for ex-dividend days alone. There is clear evidence that the α_j coefficients have changed over time, with values between 0.3 and 0.4 in Regimes I and II and much smaller values, between −0.05 and −0.1, in Regime III. This finding suggests that changes in the capital gains tax rate, the principal difference between Regimes I and II, did not exert a pronounced influence on ex-day price movements, but the reform of dividend taxation in 1973 did have a substantial effect. The difference between the Regime II and Regime III coefficients averaged across the two reported models is 0.443, which is smaller than the difference of 0.551 between the average values of δ computed in Table I.

We experimented with several variants on our ex-day equation. First, we computed two-day returns for each security, assuming that the investor held her shares for the ex-day and the following day. When we repeated our regressions on the two-day returns, the coefficients changed, although not markedly, and the basic conclusion that the 1973 tax reform had an impact on relative ex-day price movements remained.[9] These equations are reported as rows three and four in Table II. The same finding emerged when we estimated our equations on daily data including the ex-days and the following days as independent observations. The estimates of α for the first two regimes rise to over 0.4, while the estimates for Regime III remain negative; the difference between the Regime II and III coefficients was of the same magnitude as that computed using only ex-days. In each case, the difference between the Regime II and Regime III coefficients is statistically significant at the 99 percent confidence level. Our results were quite robust with respect to the exclusion of particular firms; when the equations were estimated separately for each firm, 14 of our 16 companies had estimated Regime III coefficients which were smaller than those for Regime II.

We also tried including the square of the dividend yield in our regression models to capture clientele effects. If there are dividend clienteles with high yield securities attracting low tax rate investors, then the d_{it}^2 terms should have positive coefficients. The results of adding separate squared-yield terms for each tax regime are shown in rows seven and eight of Table II. The squared terms enter with substantial negative coefficients, as predicted by the clientele theory. However, the hypothesis that the squared terms equal zero can be rejected in only one case, that of Regime II. The size of the clientele effect is estimated to be smaller under Regime III than under previous regimes, suggesting that clientele effects may be more pronounced during times when dividend tax rates are higher. This issue will be investigated further in future work.

Finally, we tested the "tax-effects" hypothesis exploiting both the within-regime and the across-regime variation in tax rates. We then compared the estimate of $\hat{\alpha}$ for *each year* with δ in Table I. The hypothesis that $\hat{\alpha}_t = \delta_t$ for all t

[9] Further work must consider whether there are unusual share price movements for the few days before or after ex-days, as Black and Scholes [3] suggested occur in the U.S. Mas [28] has provided preliminary evidence, suggesting anomalies like those in the United States also occur in Britain.

Table II

Ex-Dividend Day Return Regressions

Equation	Data Set	Firm-Specific Intercepts	Implicit Tax Rate			Number of Observations	R^2
			Regime I	Regime II	Regime III		
1.	Ex-Days Only	No	0.319	0.302	−0.055	633	0.384
			(0.062)	(0.070)	(0.065)		
2.	Ex-Days Only	Yes	0.440	0.413	−0.061	633	0.482
			(0.081)	(0.086)	(0.080)		
3.	2-Day Returns	No	0.345	0.322	−0.062	584	0.443
			(0.084)	(0.103)	(0.096)		
4.	2-Day Returns	Yes	0.429	0.421	0.042	584	0.533
			(0.100)	(0.113)	(0.109)		
5.	All Days	No	0.414	0.413	−0.052	1217	0.416
			(0.033)	(0.037)	(0.034)		
6.	All Days	Yes	0.442	0.416	−0.057	1217	0.483
			(0.058)	(0.061)	(0.057)		
7.	All Days	No	0.544 (0.097)	0.699 (0.110)	0.033 (0.101)	1217	0.424
			−3.861 (2.761)	−8.531 (3.336)	−2.282 (2.840)		
8.	All Days	Yes	0.842 (0.205)	0.979 (0.223)	0.362 (0.206)	1217	0.484
			−7.107 (4.021)	−11.911 (4.713)	−6.971 (4.007)		

Notes: All equations correspond to the model

$$g_{it} + d_{it} = \beta_{0i} + \beta_{1i} \cdot R_{mt} + \alpha_1 I_{1it} d_{it} + \alpha_2 I_{2it} d_{it} + \alpha_3 I_{3it} d_{it} + \varepsilon_{it}.$$

The β_{0i} coefficients are firm-specific intercept terms, β_{1i} are company betas, and α_1, α_2, and α_3 are the implicit tax effects corresponding to each tax regime. Standard errors are shown in parentheses. For Equations 7 and 8, each α_j is amended to $\alpha_{0j} + \alpha_{1j} \cdot d_{it}$; the first coefficient is α_{0j} and the second α_{1j}.

Table III

Time Series Movements in Dividend Valuation

Year	Estimated α
1956	0.149 (0.177)
1957	0.439 (0.165)
1958	0.393 (0.151)
1959	0.637 (0.182)
1960	0.361 (0.201)
1961	−0.142 (0.207)
1962	0.378 (0.194)
1963	0.276 (0.205)
1964	0.050 (0.174)
1965	0.304 (0.186)/0.546 (0.240)
1966	0.272 (0.150)
1967	0.259 (0.148)
1968	0.254 (0.190)
1969	0.460 (0.180)
1970	0.459 (0.151)
1971	0.298 (0.145)
1972	0.455 (0.180)
1973	0.365 (0.305)/−0.044 (0.297)
1974	−0.146 (0.160)
1975	−0.600 (0.185)
1976	−0.031 (0.164)
1977	−0.109 (0.174)
1978	−0.115 (0.168)
1979	−0.056 (0.137)
1980	−0.093 (0.139)
1981	−0.064 (0.145)

Notes: The coefficients were estimated from the equation:

$$R_{it} = \beta_{0i} + \beta_{1i} \cdot R_{mt} + \sum_{j=1956}^{1981} \alpha_j I_{jit} \cdot d_{it} + \nu_{it}.$$

The data set including only ex-days was used. The variables I_{jit} are indicator variables showing that the it^{th} dividend fell within year j. Standard errors are shown in parentheses.

was rejected at standard significance levels. However, tests using $\hat{\alpha} = (m - \tau_a)/(1 - \tau_a)$, imposing $z = 0$, did not reject the null hypothesis. This suggests that our measures of capital gains tax rates may be very imprecise indicators of actual tax rates.

Table III reports further analysis of the daily data, with estimates of Equation (2) from Table II allowing separate α_j coefficients for each year.[10] When the tax

[10] Previous research, such as that of Gordon and Bradford [13], has documented the existence of large fluctuations in estimated tax effects even over periods when the tax law was stable. They also found using monthly data that α declined between 1925 and 1935, even though dividends were not taxed in the U.S. until 1936. However, their results may be driven by the large changes in riskiness and required returns during the Depression period.

regime changed *during* the year, we estimated separate coefficients for the two regimes. The coefficients are clearly subject to substantial variability, even within tax regimes. However, there is a pronounced drop in these coefficients beginning in the second half of 1973, again suggesting the importance of tax effects. There is no comparable change in 1970, when the tax rules on trading were changed.

While daily share price movements are likely to yield the most precise evidence on dividend valuation, they may be contaminated by tax arbitrage or other unusual patterns around ex-days. If taxes play an important role in the valuation of dividend income, then it might be possible to detect this phenomenon in a large sample of monthly security returns. While monthly data are subject to various other biases discussed below, we now turn to an analysis of tax effects in monthly data for the period 1955–81.

III. Dividend Valuation: Tests Using Monthly Data

A. Methodology

A simple model, which we use as a point of departure for estimation, is the after-tax CAPM described by Litzenberger and Ramaswamy [24]. The tax-modified capital market line requires that for each security i,

$$(1 - z)g_{it} + (1 - \hat{m})d_{it} = (1 - m)r_{ft} + \beta_i[(1 - z)g_{mt} + (1 - \hat{m})d_{mt} - (1 - m)r_{ft}] + \varepsilon_{it} \quad (5)$$

where $(1 - m)r_{ft}$ is the after-tax rate of return on the risk-free asset, $\hat{m} = \frac{m - \tau_a}{1 - \tau_a}$, g_{mt} and d_{mt} are the capital gains and dividends on the market portfolio, $\beta_i = \text{Cov}(\tilde{R}_{it}, \tilde{R}_{mt})/\text{Var}(\tilde{R}_{mt})$, m is the marginal tax rate on interest income, and z is the capital gains tax rate. We use $\sim$ above a return to show that it is measured after tax. Dividing through Expression (5) by $(1 - z)$ and manipulating terms yields

$$R_{it} = g_{it} + d_{it} = \frac{(1 - \beta_i)}{(1 - z)}(1 - m)r_{ft} + \beta_i[g_{mt} + (1 - \delta)d_{mt}] + \delta d_{it} + \varepsilon_{it}. \quad (6)$$

In daily data, the variation over time in the risk-free rate and the market dividend yield is small, so we could approximate (6) by

$$R_{it} = \beta_{0i} + \beta_{1i}g_{mt} + \alpha d_{it} + \nu_{it}. \quad (7)$$

This was the equation which we estimated in the last section. In monthly data, however, the specification of ex ante returns is more important. We therefore employed two alternative models. The first followed from (5):

$$R_{it} - (1 - m)r_{ft} - \beta_i(R_{mt} - (1 - m)r_{ft}) = \alpha_0 + \alpha_1 I_{1it}d_{it1} + \alpha_2 I_{2it}d_{it} + \alpha_3 I_{3it}d_{it} + u_{it} \quad (8)$$

where R_{mt} is the total return on the market and u_{it} is an error which is assumed

to be uncorrelated across firms and time.[11] Again, the I_{jit} are indicator variables for different tax regimes.

To estimate this model, we first estimated a set of $\hat{\beta}_{it}$ for each firm from regressions of the total security return on the market return. We allowed $\hat{\beta}_i$ to vary during the sample, fixing it for five-year intervals. The results were not particularly sensitive to our choice of interval length. We also tried a two-stage procedure, used by Gordon and Bradford [13], which began by defining $R_{mt} = d_{mt} + g_{mt}$, estimating $\hat{\beta}_{it}$, and estimating $\hat{\alpha}$ for each regime. We then *redefined* $\tilde{R}_{mt} = (1 - \hat{\alpha})d_{mt} + g_{mt}$, similarly adjusted share returns as $\tilde{R}_{it} = (1 - \hat{\alpha})d_{it} + g_{mt}$, and used these new returns to estimate new $\hat{\tilde{\beta}}_i$'s. The new $\hat{\tilde{\beta}}_i$'s were then used to form the left-hand side variable in (8). Our results were insensitive to these experiments; the findings reported below correspond to β_{it}'s estimated from unadjusted R_{mt} and R_{it}.

Estimating α_j's from (8) may be subject to serious biases if the assumptions underlying the CAPM are not valid, or if β's cannot be accurately estimated. The substantial problems of infrequent trading and the failure of stock market returns to measure the return on the whole constellation of assets held by investors complicate the estimation of β_i. For a relatively small open economy like Britain, it is especially unlikely that the aggregate stock market is a very good proxy for total wealth.

Failure to adequately proxy ex ante returns has potentially serious consequences, particularly in working with monthly data. Because increases in ex ante returns depress stock prices, they will be associated with increases in dividend price ratios. These may lead to upward biased estimates of the tax effects on the valuation of dividends. To control for this possibility we follow Miller and Scholes [33], and add a variable $\bar{P}_i/P_{it}$ where P_{it} represents the split-adjusted mean price of security i in our sample. This variable is intended to pick up the effects of unmeasured risk changes which affect the firm's price. The expected sign of this variable's coefficient is positive. When the risk of a security rises, its price will decline, and provided dividends adjust slowly to new information its dividend yield will rise. At the same time, the ex ante return on this security will rise, leading to a positive association between measured dividend yield and return. To capture other possible misspecifications, the average dividend yield over the past year, $(\overline{D/P})$, was also added to Equation (8).

We also employed an alternative approach which imposed fewer theoretical constraints on the data. We assumed that

$$R_{it} = u_t + \beta_{0i} + \alpha_1 I_{1it} d_{it} + \alpha_2 I_{2it} d_{it} + \alpha_3 I_{3it} d_{it} + \varepsilon_{it}. \tag{9}$$

Equation (9) is a standard model in the analysis of covariance; it allows for firm effects and time effects in describing stock market returns. Each firm is assumed

[11] The assumption of independence across firms at any moment is usually rejected by securities data, and corrective estimation techniques (Zellner's SUR method) have been applied by Gibbons [12] and Hess [16, 17]. Because our monthly sample of firms is so large, these procedures were computationally impractical. Equation (6) implies that the constant term in (8) should be zero. We include an intercept in (8) and all estimating equations to capture possible misspecifications. The zero-beta after-tax CAPM suggested by Litzenberger and Ramaswamy [24] would require $\alpha_{0i} = (1 - \beta_i)\alpha_0$. This specification is discussed further below.

to have a constant required excess return on an after-tax basis and there is some "market news" which affects all firms at time t.[12]

Before presenting our monthly regression results, there is one remaining methodological issue to discuss. It involves information effects and the relationship between yields and returns. The problem arises if dividends are announced and paid in the same month. In this case, there will be a positive correlation between announced dividends and "dividend news." Assuming that the announcement of higher than expected dividends causes stock prices to rise, information effects will give rise to a spurious positive correlation between yields and returns. Miller and Scholes [33] point out an additional, more subtle bias. Some firms that pay zero dividends undoubtedly surprised and disappointed their shareholders by omitting their dividend. This also leads to an upward bias in the estimate of the effect of dividend yields on returns.

We adopted two different procedures for addressing this problem. The first is a variant on one of the procedures used by Litzenberger and Ramaswamy [26]. We included in the sample only company-month observations for which i) positive dividends were paid, but the dividend had been announced in the preceding month, or ii) no dividends were paid but positive dividends had been paid within the preceeding two months. The logic of this selection rule is that market participants are unlikely to expect dividends to be paid within two months of a previous dividend payment, especially since in Britain dividends are almost universally paid on a semiannual basis. Restricting the sample to these observations should eliminate most[13] of the bias due to information effects.

Unfortunately, data on dividend announcement dates were only available for part of our sample period (1965–1977). The restricted sample method could therefore not be used to estimate yield effects over the entire 1955–1981 period. To obtain estimates for the full sample period, we adopted an instrumental variable procedure similar to that suggested by McCallum [29] in the context of rational expectations macromodels. The basic idea is as follows. Suppose x_t^e is a rational expectation of x_t conditional on some information set Ω_t. It then follows that:

$$x_t = x_t^e + \theta_t \tag{10}$$

where θ_t is orthogonal to any element of the information set Ω_t. Equation (10) implies that the use of x_t as a proxy for x_t^e gives rise to a classical errors-in-variables problem. It may be solved by using any element of Ω_t that is correlated with x_t^e as an instrument for x_t. We therefore use average lagged dividend yield as an instrument for the contemporaneous dividend yield in those months in which a dividend was paid. The definition of our instrument is $d_{it}^* = (d_{it-11} + d_{it-12} + d_{it-13})$, which is essentially this month in the previous year's dividend yield, with a minor correction to allow for possible timing differences in two consecutive years.[14] When $d_{it} = 0$, our instrumental variable was also set equal

[12] In principle, Equation (9) could be estimated directly by adding a dummy variable for each firm and each month to our regressions. This is not practical due to the size of our sample. An alternative approach, described in Maddala [27], is to subtract the means for each firm and for each month from each variable in (9); we employed this technique.

[13] If some firms in our sample were expected to announce dividends in the two months after their last dividend, but did not, a small "dogs that don't bark" bias may remain.

[14] The use of lagged dividend information forced us to eliminate the first 12 monthly observations for each firm.

to zero. This may leave some small residual bias but it should be common to all firms, and reasonably constant over time.[15]

It is important to recognize that the biases in estimated tax effects due to information effects and mismeasurement of risk should affect the yield-return relationship in a similar way during all tax regimes. By studying the *differences* in estimated yield effects under alternative tax regimes, we are able to measure tax effects with less contamination by other spurious factors than many previous studies. Failures in our model of ex ante returns and other specification errors are likely to exert a roughly constant bias in all regimes. The *variation* in coefficients across tax regimes should therefore be the focus of our attention.

Our monthly returns data were drawn from the London Business School share price data base. This data set includes monthly observations on prices, dividend payments, and market indices for 3,500 U.K. firms during a 26-year period between 1955 and 1981. There are a total of over 550,000 company-months of share price information. Although 3,500 companies are contained in the data set for at least some months, many appear for only short periods. The full data set contains many firms which evidence severe nontrading, and we report results based on a subset of the complete data tape.

B. *Results*[16]

Estimates of Equations (8) and (9) using the restricted data sample of firms without announcement or information biases are presented in Table IV.[17] The

[15] This instrumental variable procedure does not require us to use all available lagged information in forming our estimate of X_t^e. It is consistent so long as some elements of the relevant information set Ω are employed. Our instrumental variable procedure differs from the iterated least squares procedure used by Litzenberger and Ramaswamy [24, 26] and many other authors. These authors use a first-stage regression to create an expected dividend yield variable which they then included in estimating an equation like (8). However, as Hausman [15] explains, this procedure is inappropriate because, to ensure consistency, all the variables included on the right-hand side of any second-stage equation must be included in the first-stage equation as well. Moreover, even if all the appropriate variables are included, the standard errors will be misstated if a two-stage procedure is used.

[16] To avoid infrequent trading problems, we selected only months in which both the recorded price and the previous month's recorded price were transactions prices for the last day of the month. This restriction substantially reduced the size of our sample, from 550,000 to about 140,000 company-months. This procedure both reduces the nontrading problem which may lead to poor estimates of β_i and avoids the problem of firms which experienced ex-days during a month but were last traded before the ex-date. We also deleted i) any firms for which we has less than 12 admissable observations, on the grounds that the estimated β's would be poor guides to actual betas, ii) outlying observations on dividend yield (>25% per year) and share price movements (any observation corresponding to more than a 50 percent price movement during one month), and iii) any months involving noncash dividends or special rights issues. Finally, we examined only observations on firms in the first third of the value distribution for 1981, although the findings are not particularly sensitive to choosing alternative cut-off points. This firm size criterion reduced our sample size to 38,000 company-months. Costas Kaplanis of the London Business School is currently engaged in related research which examines the return behavior of a larger group of firms on the tape.

[17] Other variables in the monthly regressions were measured as follows. We calculated the after-tax risk-free return as $(1 - m)r_{ft}$, where m is a time series on the weighted average marginal tax rate on interest income calculated by Ohrnial and Foldes [36] and Ohrnial [35], recently extended by King, Naldrett, and Poterba [22]. The risk-free return was measured as the short-term Treasury bill rate from the LBS Indices file. We calculated R_{mt} as the sum of the capital gain and dividend yield components in the *Financial Times*-Actuaries 500 Share Industrial Index.

Table IV

Monthly Return Regressions

Equation	Constant ($\times 10^{-3}$)	Implicit Tax Price			$\overline{(D/P)}$	$\bar{P}_i/P_{it}$	R^2
		Regime I	Regime II	Regime III			
4a CAPM	−3.619	0.900	0.741	0.453	—	—	0.529
	(1.243)	(0.361)	(0.118)	(0.126)			
4b CAPM	−1.570	0.697	0.731	0.406	0.277	0.010	0.532
	(0.322)	(0.303)	(0.178)	(0.125)	(0.718)	(0.002)	
4c Firm and	—	0.945	0.730	0.557	—	—	0.501
Time Effects		(0.385)	(0.140)	(0.153)			
4d Firm and	—	0.895	0.757	0.576	2.41	0.0123	0.505
Time Effects		(0.386)	(0.142)	(0.153)	(1.04)	(0.0026)	
4e CAPM	−5.609	0.813	0.714	0.449	—	—	0.004
	(3.835)	(0.088)	(0.088)	(0.089)			
4f CAPM	−6.803	0.738	0.745	0.472	0.488	0.0032	0.009
	(0.739)	(0.089)	(0.088)	(0.089)	(0.073)	(0.0003)	
4g Firm and	—	0.786	0.747	0.519	—	—	0.004
Time Effects		(0.094)	(0.093)	(0.095)			
4h Firm and	—	0.791	0.749	0.517	0.998	0.004	0.008
Time Effects		(0.094)	(0.093)	(0.094)	(0.265)	(0.0003)	

Notes: Equations 4a–4d were estimated on a data subsample which comprised only company-months in which a dividend was paid, or which followed a dividend month by one or two months. We deleted all dividend observations for which announcement dates were unavailable; this excluded all data before 1965 and after 1977. Dividends which were announced in the month they were paid were also deleted, leaving a total of 4,446 observations. Equations 4e–4h are estimated using our entire data set with an instrumental variable procedure to correct for information effects. Equations 4a, 4b, 4e, and 4f were estimated by weighted least squares, others by ordinary least squares. Standard errors are shown in parentheses. The CAPM equations assumed β_i constant for six-year intervals. The R^2's for Equations 4a–4d and 4e–4h are not comparable since the latter are the share of variance explained after removing firm and time effects.

results confirm the daily findings and support the hypothesis that taxes influence the relationship between dividend yields and security returns. In the simplest specification, based on the CAPM, the estimated tax penalty on dividends falls from 74 to 45 percent between Regimes II and III. A drop-off of this magnitude corresponds very closely to the decline in average marginal tax rates reported in Table I. The evidence on changes between Regimes I and II is less clear; there are movements in both directions in the various equations, and the hypothesis of equal coefficients ($\alpha_1 = \alpha_2$) can never be rejected. Rows 4c and 4d present the results of estimating our fixed-effects models for the same restricted data sample. Again the findings suggest the importance of tax changes and the coefficients and their differences decline to magnitudes similar to those of the CAPM.

The major puzzle in the results is why the estimated tax rates are so high. Their values suggest some sort of bias due to mismeasurement of risk. Addition of variables designed to capture these biases, such as the inverse price, reduce the absolute size of the coefficients slightly, but the changes are not enough to resolve the mystery. While our coefficients are implausibly large, other authors using non-American data have found similar results. Lakonishok and Vermaelen [23] discovered that Canadian share prices often fall on ex-days by only one-

third of the dividend value, suggesting a value for δ of roughly two-thirds. These incredible values for price drop-offs should be a source of further study.

Table IV also presents estimates of the returns model for the entire 1955–1981 period using our instrumental variable procedure for handling the information effect problem. These results are shown in Rows 4e–4h. The results provide further support for the hypothesis that taxes affect the relationship between dividend yields and security returns. The estimated differences between α_2 and α_3 range between 0.25 and 0.30 for the modified CAPM equations, and are somewhat larger in the fixed-effects case. These findings suggest that the major tax reform in 1973 did not lead to changes in security returns for only a few days around the ex-day. Rather, they suggest a more persistent effect which can be traced in monthly returns.

This encouraging evidence is partially offset by the comparison between Regime I and Regime II coefficients. There are few dramatic changes, in spite of the fact that the capital gains tax should have reduced δ. The hypothesis that $\alpha_1 = \alpha_2$ cannot be rejected in any of the reported equations. We cannot therefore refute our earlier conjecture that direct dividend taxes are reflected in returns, while the effect of capital gains taxes is much more subtle.

The addition of our risk proxies, the inverse price and average dividend yield, does not alter the conclusions for the full-sample equations. While the $\bar{P}_i/P_{it}$ variable always enters with a statistically significant coefficient, it leads to only minor reductions in the level of the α_j coefficients and virtually no changes in the inter-regime differences. The average yield variable, $(\overline{D/P})$, also has a significant positive coefficient. This suggests that a higher average dividend yield *raises* the ex ante return on a security, even in the months when it is not paying dividends. However, the size of the estimated yield coefficients is implausibly large, suggesting that how dividend policy affects required returns in nondividend months should be a subject of further study.[18]

IV. Conclusions

The results in this paper suggest the importance of taxes in determining the relationship between dividend yields and stock market returns. Using both daily and monthly data on British securities, we have documented that changes in dividend taxation have a substantial effect on the premium which investors require to induce them to receive returns in the form of dividends. Our results provide ample evidence of the importance of the biases that have been extensively discussed in the literature. However, these biases due to information effects and problems of measuring risk are common to all tax regimes. Hence, our findings that the valuation of dividends *changes* across tax regimes provides strong evidence that taxes account for part of the positive relationship between yields and stock market returns. They underscore the possible biases in the level of estimated dividend valuation coefficients, and further emphasize the need for

[18] Rosenberg and Marathe [39] and Elton, Gruber, and Rentzler [8] experiment with a variety of similar modifications to the basic CAPM equation, adding average dividend yield variables.

tests which rely upon genuine variation in the tax system in studying dividends and taxes.

Our conclusions thus support inferences drawn by Auerbach [2], Elton and Gruber [7], and Litzenberger and Ramaswamy [24, 26] and cast doubt on those obtained by Miller and Scholes [33] and Gordon and Bradford [13] from American data. They not only suggest that tax changes can affect security returns, but also suggest that weighted averages of investor tax rates may provide a reasonable approximation to the tax preferences prevailing in the marketplace.

Of course, it is possible that British and American institutions differ in ways that preclude generalizing from the British experience. This seems unlikely. Miller and Scholes [32], in their analysis of the taxation of dividends in the United States, suggested that the interaction between various tax provisions can cause dramatic reductions in the effective marginal tax rate on capital income. They focused on several devices in the U.S. tax code which might reduce the effective dividend tax rate: (i) the potential for dividend income to raise the limitation on interest income deductibility; (ii) the availability of life insurance policies and single premium annuities as essentially tax-free accumulation vehicles; and (iii) the use of pension funds to allow assets to earn the before-tax interest rate. Although in principle all of these devices could generate substantial tax savings for personal investors, the extent to which they are actually used in the United States remains controversial. Feenberg [11], for example, showed that investors for whom the interest deductibility limitation was binding received only 2.5 percent of total dividend payments in 1977.

While some of the relevant tax features appear in the British tax code, others do not. Interest payments are not deductible from taxable income in the United Kingdom, except in special circumstances involving home mortgages and several other minor cases. Moreover, there are strict (and quite low) limits on the amount deductible. The first Miller-Scholes device is therefore inaccessible to British investors. The life insurance mechanism, however, may be more powerful as a tax avoidance device in Britain than in the United States. Tax subsidies are provided for the payment of insurance premia, and the proceeds of the policies are generally exempt from capital gains. Tiley [41, p. 717] observes that, "in recent years, ... taxpayers took advantage of the rules concerning relief from premiums to buy shares or unit trusts ... where income could accumulate virtually free of tax thanks to [tax] concessions for insurance companies." Finally, with regard to pension funds, the British and American systems are similar. Corporate contributions are deductible for corporate tax purposes, and individual pension contributions are not treated as taxable income. Pension funds are untaxed, and the earnings of pension funds are tax exempt. When pension income is received during retirement, it is subject to ordinary income taxation. As in the United States, the issue of whether marginal investors are accumulating through these channels is unclear. There may be other devices for sheltering income, available in the United Kingdom but not in the United States, which we have failed to mention. These would only strengthen our case, showing that the potential for tax-free accumulation is clearly present in Britain.

The most important item on the agenda for future research related to our

study is the development of a theory of why firms pay dividends in environments where they are tax penalized. Such a theory is a necessary prelude to a full understanding of the effects of dividend taxation on real economic behavior. A survey of some existing approaches and some empirical tests of their implications are presented in Poterba and Summers [38].

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